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Integrated 100 Area Remedial Investigation/ Feasibility Study Work Plan, Addendum 4: 100-FR-1, 100-FR-2, 100-FR-3, 100-IU-2, and 100-IU-6 Operable Units

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY
Richland Operations Office

P.O. Box 550
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Executive Summary

This document is Addendum 4 of the *Integrated 100 Area Remedial Investigation/ Feasibility Study Work Plan* (DOE/RL-2008-46).[1] The purpose of a work plan is to explain the Remedial Investigation/ Feasibility Study (RI/FS) project background and rationale, and provide detailed plans for investigation of contaminated sites under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*[2] (CERCLA). This document supports final remedy selection under CERCLA for 100-F/IU-2/IU-6 at the Hanford Site. The CERCLA RI/FS results are also intended to address *Resource Conservation and Recovery Act of 1976*[3] (RCRA) corrective action requirements for areas of RCRA concern. Five 100 Areas (Figure ES-1) have been defined for the River Corridor: 100-B/C, 100-K, 100-D and 100-H, 100-N, and 100-F combined with 100-IU-2/6 Operable Units (OUs). Planning for the 300 Area will be addressed separately. These areas combine groundwater contamination, soil contamination sites, and facilities in geographic areas that encompass the 100 Area National Priorities List[4] sites.

The Integrated Work Plan (DOE/RL-2008-46) implements an approach designed to reach final remediation decisions, describes key features of the planning process to support implementation of this approach, and provides important key regulatory considerations and risk assessment uncertainties common to the 100 Area. This document provides site-specific information for 100-F/IU-2/IU-6. The 100-F/IU-2/IU-6 area includes the 100-FR-1, 100-FR-2, 100-IU-2, and 100-IU-6 source OUs, the 100-FR-3 groundwater OU located beneath 100-F, and IU-2 and IU-6. The location of 100-F/IU-2/IU-6 and proximity to other areas is provided in Figure ES-1. As shown in Figure ES-1, 100-F includes the land around the F Reactor, and 100-IU-2/IU-6 encompasses the portion of land outside Hanford's Central Plateau, primary reactor operating areas, and the 300 Area.

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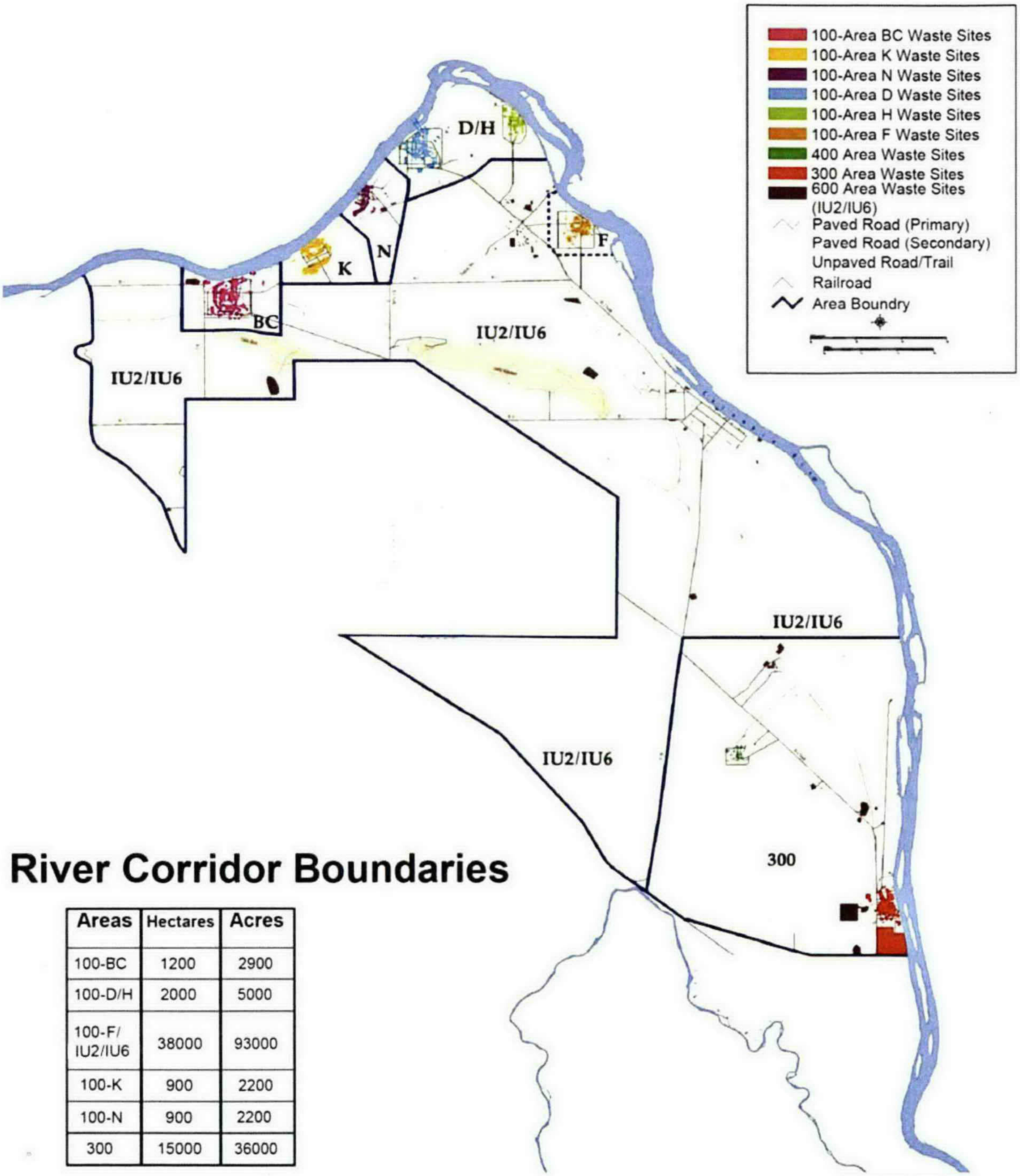
1 DOE/RL-2008-46, *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=1002260412.

2 *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq. Available at: http://epw.senate.gov/cercla.pdf.

3 *Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq. Available at: http://www.epa.gov/epawaste/inforesources/online/index.htm.

4 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_09/40cfr300_09.html.



Areas	Hectares	Acres
100-BC	1200	2900
100-D/H	2000	5000
100-F/ IU2/IU6	38000	93000
100-K	900	2200
100-N	900	2200
300	15000	36000

Figure ES-1. River Corridor Boundaries

This addendum is based on the premise that there are data gaps and uncertainties that should be addressed to support final remediation decisions. In 100-F/IU-2/IU-6, substantial work to remove contaminated soil and remove defunct facilities has been completed over the past decade or is planned over the next few years. The results of these activities provide the basis for identifying the remaining uncertainties needed to make final remediation decisions.

A systematic planning process was used to develop a program for data collection and analysis to support final remediation decisions at 100-F/IU-2/IU-6. The following key elements were identified during this systematic planning process.

Investigation work at 100-F/IU-2/IU-6 will be conducted in accordance with the Integrated Work Plan (DOE/RL-2008-46). No exceptions are noted in this addendum.

Site Background

The 100-F area encompasses the F Reactor operating region and includes the 100-FR-1 and 100-FR-2 source OUs, and the 100-FR-3 groundwater OU. The IU-2 and IU-6 source OUs cover a large area outside of the Hanford Site's primary reactor operating areas. Background information for this area includes past operational history of the facilities (with an emphasis on disposal operations), the known nature and extent of groundwater and soil contamination, known hydrogeologic information, source and groundwater remedial actions and their effectiveness, and the results of any treatability and characterization studies.

Appendix A shows the locations of 100-F Area waste sites, the locations of the 100-IU-2/IU-6 waste sites, and the F Reactor Area. Appendices B and C provide a complete listing of waste sites and facilities, including descriptions, histories, and classifications. As of December 2009, 257 waste sites and two discovery sites (259 total sites) exist within 100-F/IU-2/IU-6. Of these waste sites, 105 are within 100-F and 154 are in the 100-IU-2 and 100-IU-6 OUs. These waste sites consist mainly of inactive waste sites described as trenches, ditches, cribs, ponds, burial grounds, and unplanned releases. Some of the waste sites have been closed out on an interim basis, rejected, or identified for no action. These classifications are defined in the Integrated Work Plan (DOE/RL-2008-46). Table 3-3 summarizes the individual waste site classifications and identifies hexavalent chromium (Cr(VI)), strontium-90 (Sr-90), and orphan waste sites.

There are 84 accepted sites and 2 discovery sites in 100-F/IU-2/IU-6. Sites with a status of accepted or discovery are considered unremediated sites in this plan. Documentation to support the disposition or completion of interim remedial action at five of these sites is in progress or has been submitted to the regulatory agencies for approval. The design and active remediation of another 10 sites continues. Remedial actions and site evaluations are being planned for the remaining sites.

Initial Evaluation

The primary sources of contamination in the 100-F area of 100-F/IU-2/IU-6 is the water-cooled nuclear reactor (105-F) and the structures (e.g., fuel storage basins [FSB]) and processes (e.g., sodium dichromate process) associated with reactor operations. The reactor was built to irradiate uranium-enriched fuel rods from which plutonium and other special nuclear materials could be extracted (in the 200 Area). The processes associated with reactor operations generated large quantities of liquid and solid wastes. Liquid and solid wastes from reactor operations and associated facilities, as well as from the Experimental Animal Farm (EAF), were released to the soil column and the Columbia River. Sources of contamination include spills, leaks, and past liquid and solid waste disposal sites.

The impact of Hanford site-specific past practices in the 100-IU-2 and 100-IU-6 OUs is limited in nature. Most identified waste sites in this area can be traced to pre-Hanford activities (agricultural, domestic) or non-production-related activities such as temporary worker housing or security. Extensive investigations have been conducted to identify these sites and verify their existence as pre-Hanford or non-production-related features.

Hydrologic processes have influenced contaminant distribution in the subsurface as well as groundwater flow. Processes affecting contaminant migration continue (e.g., changing river stage). Effects of local anthropogenic alterations to groundwater flow have diminished over time with the cessation of reactor operations (e.g., no more coolant disposal).

Conceptual Site Model

The Conceptual Site Model (CSM) is a description of the site that organizes the available information and provides a summary of the site conditions. The CSM is developed to depict what is known about the site history (including process history), concentrations and location of contamination, and information needed to support decisions on remediation. The CSM is used to identify data and information gaps, establish data needs, and design a field program to address the gaps.

Hexavalent chromium (Cr(VI)), nitrate, Sr-90, and trichloroethene (TCE) have been detected at concentrations above the water quality standards in the upper part of the unconfined aquifer in the 100-F Area. The spatial extent of contamination has not been defined in all locations, and the vertical distribution of contamination has not been characterized. In addition, not all groundwater contaminants of potential concern (COPCs) are routinely monitored.

Historical records show that Cr(VI) was released into the environment primarily as a dissolved species in two types of solutions: stock solutions used to make reactor coolant and the reactor coolant itself. Unlike the Cr(VI) contamination observed from the process at 100-D, it appears that only relatively low concentration Cr(VI) waste was discharged to the subsurface at 100-F because of the production facility setup. There was a much longer period where dry dichromate powder was used to mix corrosion control solutions for 105-F Reactor water treatment as compared to other 100 Area reactors, and the installation of newer equipment during the plant upgrades diminished the opportunity for leaks of the concentrated 70 percent solution. However, the delivery of the 70 percent solution into the storage tanks at 185/190-F (DUN-1818, *Discharge of Sodium Dichromate Solution, Compliance with Executive Order 11258*[5]) was not completely efficient, and yellowish stained soil around the storage tank location indicate some losses. The fraction of delivered 70 percent solution lost to the subsurface is not known; however, the current concentrations observed in groundwater do not indicate the presence of a highly concentrated, persistent source.

[5] DUN-1818, 1966, *Discharge of Sodium Dichromate Solution, Compliance with Executive Order 11258*, Douglas United Nuclear, Inc., Richland, Washington.

The EAF, formerly located in the northeast portion of 100-F near the 116-F-9 Trench and 116-F-2 Trench, was used to test the effects of radioactivity and radiological contamination on living organisms, including both plants and animals, and is a likely source for the current nitrate contamination. Nitrate is a common component of animal urine and feces. Since the animal pens had dirt floors, the disposal of contaminated urine and manure directly to the floors of the pens contributed to nitrate contamination in this area, over and above conventional laboratory and decontamination use during production. An additional source of nitrate is the pre-Hanford agricultural use.

Facilities producing biological waste materials contaminated with Sr-90 included the EAF and radioecology laboratory. The EAF was located within the current footprint of the Sr-90 plume within 100-F. The most likely explanation for the continued elevated presence of Sr-90 in groundwater within 100-F is the use of Sr-90 in biological experiments. Possible sources are releases from its use in biological experiments at the EAF and discharges to the 116-F-9 Trench. The disposal of contaminated urine and manure directly to the ground (via animal pens with dirt floors), coupled with the moderate solubility of Sr-90, most likely contributed to some accumulation in the vadose zone. Strontium-90 was also present in solid waste disposed at various burial grounds. The 118-F-1 and 118-F-6 solid waste burial grounds are located southwest of the 105-F Reactor. These are also possible sources of current aquifer contamination, although these locations are much less likely to be significant compared to liquid discharge sites.

In 1993, the Limited Field Investigation (LFI) conducted for 100-FR-3 identified TCE as a COPC (DOE/RL-93-83, *Limited Field Investigation Report for the 100-FR-3 Operable Unit* [6]). In groundwater samples collected in 1994, TCE was detected at concentrations exceeding the state and federal drinking water standards of 5 micrograms per liter (μg/L). The source of the TCE groundwater plume has not yet been identified. However, concentrations within the plume have been decreasing; therefore, a concentrated residual source of TCE is not suspected.

The impact of past practices in the 100-IU-2 and 100-IU-6 OUs is limited in nature, and is predominantly nonradioactive. Most waste sites in this area can be traced to pre-Hanford activities (agricultural, domestic) or non-production-related activities such as temporary worker housing or security. Extensive investigations have been conducted to identify most

[6] DOE/RL-93-83, 1994, *Limited Field Investigation Report for the 100-FR-3 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

of these sites as pre-Hanford or non-production-related features. These sites do not appear to have had a significant impact on groundwater. Groundwater contamination in the 100-IU-2 and 100-IU-6 OUs (e.g., tritium and iodine-129) has sources in the 200 Area. These plumes are addressed as part of the 200-BP-5 and 200-PO-1 groundwater OUs.

Work Plan Rationale and Tasks

Based on the previous information available and the current understanding of contaminants in 100-F/IU-2/ IU-6, a list of data gaps (or statements of uncertainty) was identified, as presented in Table ES-1. Each of the data gaps are defined by a data need that, when filled, provides information to reduce or eliminate the uncertainty associated in the data gap to the degree needed to make a final cleanup decision.

Table ES-1 provides a summary of the data gaps and needs, as well as the specific work proposed for this work plan. The proposed field sampling locations are shown in Figures ES-2 and ES-3. Several ongoing programs (e.g., facility demolition, waste site remediation, and orphan site evaluation) are also expected to provide data that will resolve many of the uncertainties identified for 100-F/IU-2/IU-6. The Sampling and Analysis Plan (SAP) (DOE/RL-2009-43, *Sampling and Analysis Plan for the 100-FR-1, 100-FR-2, 100-FR-3, IU-2, and IU-6 Operable Units Remedial Investigation/Feasibility Study*[7]) identifies only those data collection activities that these ongoing programs will not address. The RI/FS report developed for 100-F/IU-2/IU-6 will take full advantage of data and information obtained by ongoing groundwater monitoring and remediation programs that are available during the development of the report. The results of ongoing deactivation, decommissioning, decontamination, and demolition (D4), waste site interim remediation actions, and groundwater monitoring activities, in addition to proposed investigations, will be used in the selection of final remedies and will be incorporated into a proposed plan that will lead to a final Record of Decision (ROD).

Project Schedule

The RI/FS and Proposed Plan are scheduled to be completed by November 30, 2011, and the ROD is estimated to be issued by April 30, 2012.

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[7] DOE/RL-2009-43, 2009, *Sampling and Analysis Plan for the 100-FR-1, 100-FR-2, 100-FR-3, IU-2, and IU-6 Operable Units Remedial Investigation/Feasibility Study,* U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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Table ES-1. 100-F/IU-2/IU-6 Data Gaps

Data Gap	Data Gap No.	Data Need	Description	Additional Data Collection Recommended?	Scope of Work	Justification
Data are needed to refine the conceptual site model of contaminant distribution beneath unremediated waste sites.	1	Assess the nature and vertical extent of contamination beneath unremediated waste sites.	Continue interim remedial actions, as they have proven to be efficient in obtaining the necessary data during remediation. Obtain data documenting the remaining residual contamination following completion of the interim remedial actions.	Yes	Complete contaminated soil removal and sampling at 14 waste sites in 100-F and 70 waste sites in the 100-IU-2 and IU-6 OUs. The unremediated waste sites are listed in Appendix B, and the SAP (DOE/RL-2009-43). A site-specific evaluation shall be performed on site 100-F-59 to determine if existing data are consistent with the current RCBRA.	The Remediation is needed to protect human health and the environment. Data collected upon completion of remediation are needed to assess risk from direct exposure, protection of groundwater, and protection of the Columbia River. Data collected from 100-F-59 indicate that contaminant concentrations are above background concentrations. A site-specific evaluation is needed to support final remedy selection.
Data are needed to refine the conceptual site model of contaminant distribution beneath selected remediated waste sites.	2	Assess the nature and vertical extent of contamination beneath selected remediated waste sites.	Drill two boreholes and collect samples for analysis for target analytes to assess the vertical extent of contamination in the vadose zone at the borehole locations.	Yes	Drill one borehole each at the following waste sites: the 116-F-14 Retention Basin and the 118-F-1 Burial Ground. Collect and analyze soil samples for target analytes. Details are presented in the SAP (DOE/RL-2009-43).	Characterization is needed to validate interim remedial action, and address uncertainty regarding the nature and extent of residual contamination in the vadose zone.
Data are needed to refine the conceptual site model of contaminant distribution beneath and around reactor structures.	3	Assess the nature and vertical extent of contamination in the vadose zone around the 105-F Reactor structure.	Drill one borehole near the reactor structure in an area most likely to be contaminated and collect samples for analysis for target analytes to assess the vertical extent of contamination in the vadose zone.	Yes	A borehole in the boundary of the 118-F-8 Reactor Fuel Storage Basin will be drilled and soil samples will be collected and analyzed to target analytes. Details are presented in the SAP (DOE/RL-2009-43).	The 118-F-8 Reactor Fuel Storage Basin was selected for additional characterization because of documented leaks at this location.
The nature and extent of contamination exceeding cleanup standards in the unconfined aquifer has neither been defined in all areas nor for all COPCs.	4	Identify groundwater contaminants and define the extent of contamination both horizontally and vertically.	Groundwater contamination has been detected at concentrations above water quality standards in the unconfined aquifer in 100-F. The extent of contamination in the unconfined aquifer has not been fully defined horizontally or vertically.	Yes	Install two new groundwater monitoring wells (Figure ES-2). Well 1 will be installed to further define the extent of Cr(VI). Well 2 will be installed to further define the extent of Sr-90. Well 3 will be drilled into the RUM Unit and will define the vertical distribution of contaminants through the unconfined aquifer and within the RUM Unit. Groundwater samples will be collected at various depths and analyzed for COPCs, as specified in the SAP. Sample new and existing monitoring wells for all groundwater COPCs. Details are found in the SAP (DOE/RL-2009-43). Sampling will also be conducted to address data gap No. 8.	New wells are proposed to further define the extent of Cr(VI) and Sr-90 contamination. The extent of Cr(VI) contamination has not been sufficiently defined to the west of Well 199-F5-6. The extent of Sr-90 contamination has not been sufficiently defined to the south of the 116-F-14 Retention Basin.
Contaminant concentrations entering the Columbia River are not well known.	5	Data from the aquifer tube network are needed to monitor contaminant concentrations over time and with depth near the river.	Aquifer tubes have been installed to analyze groundwater contaminants discharging to the river. These aquifer tubes are typically analyzed for contaminants once a year.	Yes	Continue routine sampling of existing aquifer tubes per the *SAP for Aquifer Sampling Tubes* (DOE/RL-2000-59[8]).	Continued sampling is needed to define the nature and extent of groundwater contamination approaching and entering the river.
Contaminant fate and transport beneath the unconfined aquifer have not been evaluated sufficiently over 100-F/IU-2/IU-6.	6	Evaluate the integrity of the aquitard unit and contaminant fate and transport within the aquitard.	The RUM Unit is currently considered an aquitard. The integrity of the aquitard unit and potential contaminant transport within the aquitard have not been evaluated.	Yes	Collect split-spoon soil samples from 1.5 m (5 ft) into the RUM Unit during drilling for new wells 1 and 2, and 15 m (50 ft) into the RUM Unit during drilling for new Well 3 (Figure ES-2). Screen Well 3 within the first water-bearing zone within the RUM Unit and analyze groundwater samples for COPCs.	Only one well has been completed within the RUM Unit in 100-F/IU-2/IU-6. Data are needed to confirm that the RUM Unit serves as an aquitard and that groundwater within the RUM Unit is not contaminated.

[8] DOE/RL-2000-59, *Sampling and Analysis Plan for Aquifer Sampling Tubes*, Draft A, U.S. Department of Energy, Washington, D.C. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D8509895.

Table ES-1. 100-F/IU-2/IU-6 Data Gaps

Data Gap	Data Gap No.	Data Need	Description	Additional Data Collection Recommended?	Scope of Work	Justification
Data are needed for a better understanding of hydrogeological conditions, aquifer and surface water interactions, and contaminant mobility through the vadose zone.	7	Geological characterization, physical, and hydraulic property data are needed to support modeling and analysis.	On selected soil samples, evaluate hydraulic and other properties, analyze target compound concentrations, and perform batch leach tests. Analyze groundwater samples collected during drilling for COPCs. Collect soil and groundwater samples from the (1) vadose zone, (2) deep vadose zone, (3) rewetted zone, (4) shallow unconfined aquifer, (5) deep unconfined aquifer above the RUM Unit, and (6) within the RUM Unit.	Yes	Drill and sample soil and groundwater from the three new wells (Figure ES-2). Drill Wells 1 and 2 to a depth of 5 m (15 ft) into the RUM Unit, and drill Well 3 to a depth of 15 m (50 ft) into the RUM Unit. Screen Well 3 in the first water-bearing zone encountered in the RUM Unit. Analyze soil samples collected from the vadose zone, unconfined aquifer, and RUM Unit and analyze groundwater samples from the unconfined aquifer and the RUM Unit (if sufficient water is available for sampling) per the SAP. Install and monitor pressure transducers in selected wells to determine horizontal hydraulic gradient and vertical gradient.	Data are needed to support fate and transport modeling and evaluate the causes of contaminant persistence.
Data are needed to reduce the uncertainty in the nature and spatial and temporal distribution of groundwater contamination.	8	Reduce uncertainty in assessing risks posed by groundwater contamination.	Obtain groundwater data that are spatially representative of the area, that aid evaluation of river stage influence, and are inclusive of all COPCs.	Yes	Collect and analyze groundwater samples from 55 groundwater monitoring wells in 100-F/IU-2/IU-6 to characterize the nature and extent, and temporal variability, of groundwater contamination. Three rounds of groundwater sampling will be conducted, during high, low, and transitional river stage. Wells are shown in Figures ES-2 and ES-3. Details are presented in the SAP (DOE/RL-2009-43).	Groundwater data are needed to assess the full suite of COPCs and evaluate spatial and temporal uncertainties associated with the RCBRA. Many of the wells are sampled to also achieve objectives of the 200 Area groundwater OUs; sampling and analysis are coordinated to avoid duplication of effort.

Note:

COPC = contaminant of potential concern

Cr(VI) = hexavalent chromium

OU = Operable Unit

RCBRA = River Corridor Baseline Risk Assessment

RUM = Ringold Formation Upper Mud Unit

SAP = Sampling and Analysis Plan

Sr-90 = Strontium-90

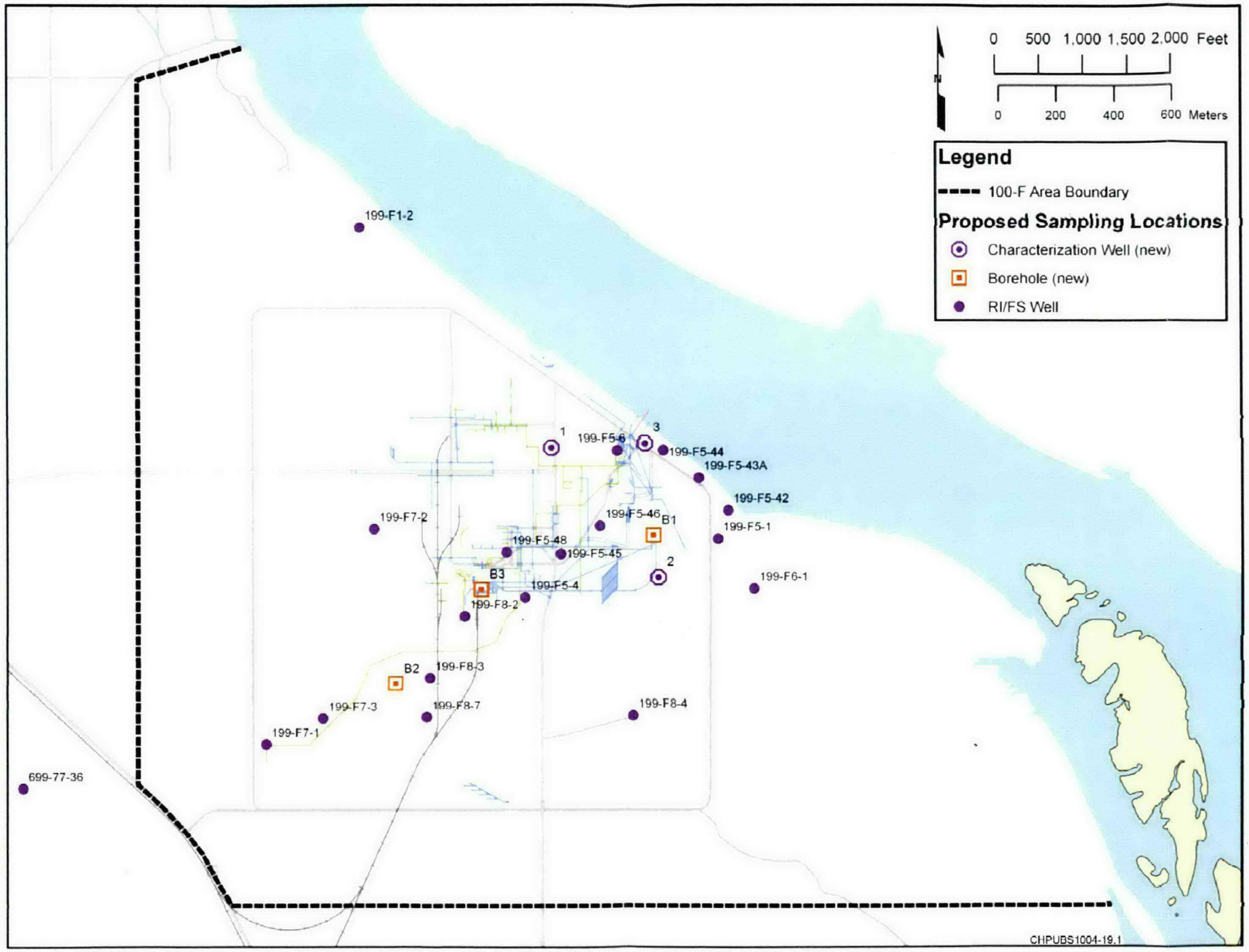

Figure ES-2. Proposed 100-F/IU-2/IU-6 Remedial Investigation/Feasibility Study Field Sampling Locations in 100-F

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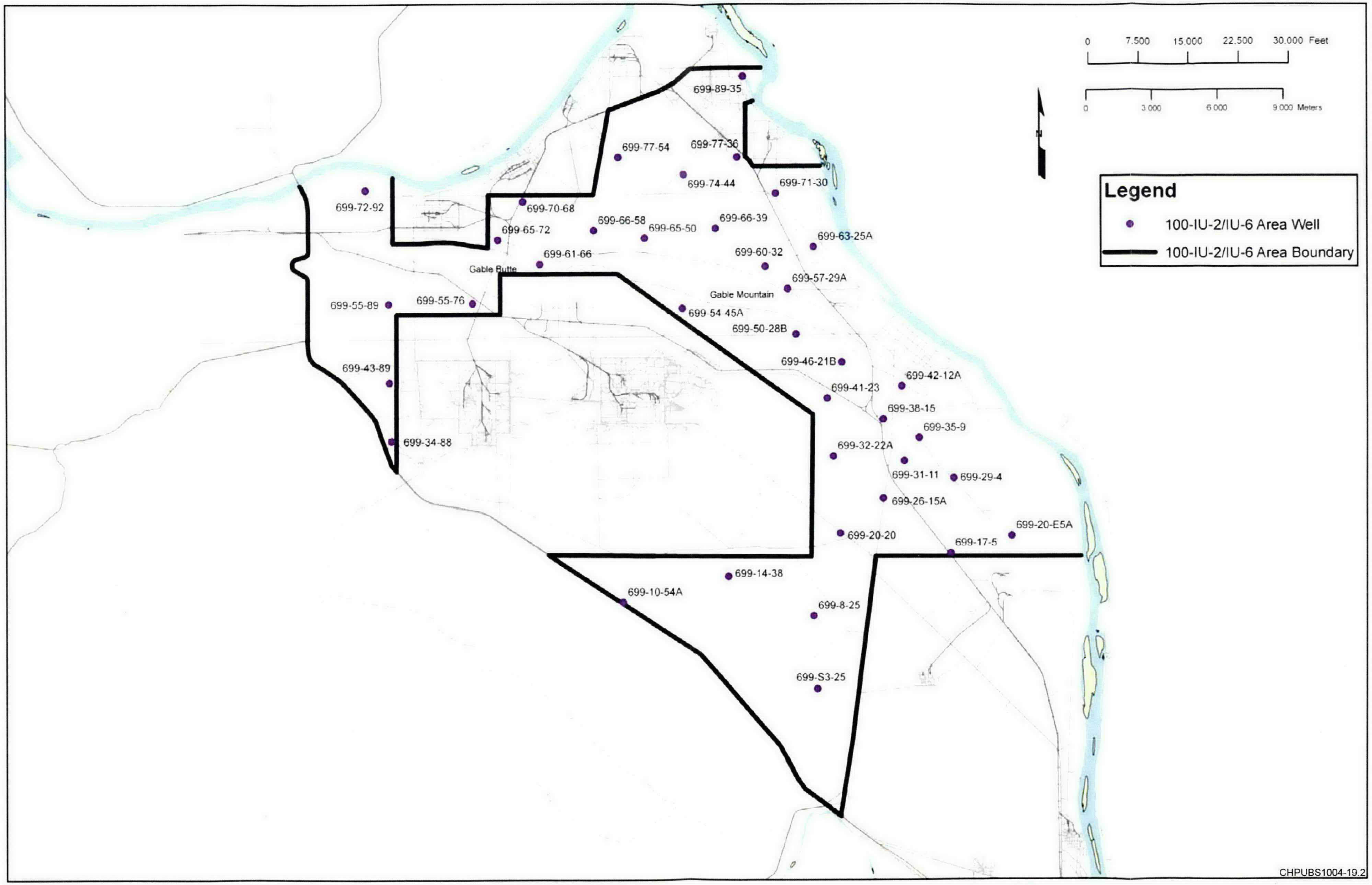

Figure ES-3. Proposed 100-IU-2/IU-6 Operable Unit Remedial Investigation/Feasibility Study Spatial and Temporal Groundwater Sampling Locations

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Contents

Appendices

Figures

Tables

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Terms

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
Ci	curie
CLP	Contract Laboratory Program
COC	contaminant of concern
COPC	contaminant of potential concern
Cr(VI)	hexavalent chromium
CSM	conceptual site model
CVP	cleanup verification package
D4	deactivation, decommissioning, decontamination, and demolition
4,4'-DDD	dichlorodiphenyldichloroethane
4,4-DDE	dichlorodiphenyldichloroethylene
4,4'-DDT	dichlorodiphenyltrichloroethane
DOE	U.S. Department of Energy
DWS	"National Primary Drinking Water Standards"
EAF	Experimental Animal Farm
Ecology	Washington State Department of Ecology
EHQ	Ecological Hazard Quotient
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FS	feasibility study
FSB	Fuel Storage Basin
gpd	gallons per day
HEW	Hanford Engineers Work
HQ	hazard quotient
HSB	Hanford Site Background
ICR	incremented cancer risk

ISS	interim safe storage
K_d	soil distribution coefficient
L/day	liters per day
LFI	limited field investigation
MTCA	Model Toxic Control Act
OSE	orphan site evaluation
OU	operable unit
PCB	polychlorinated biphenyl
PNL	Pacific Northwest Laboratory
PNNL	Pacific Northwest National Laboratory
PRG	Preliminary Remediation Goals
QRA	qualitative risk assessment
RAO	remedial action objectives
RCBRA	River Corridor Baseline Risk Assessment
RCRA	*Resource Conservation and Recovery Act of 1976*
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	record of decision
RTD	removal, treatment, and disposal
RSVP	remaining sites verification package
RUM	Ringold Upper Mud
SAP	sampling and analysis plan
SVOC	semi-volatile organic compound
TBD	to be determined
TCE	trichloroethene
Tri-Party Agreement	Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order*
µg/L	micrograms per liter
UNI	United Nuclear Industries
VOC	volatile organic compound
WAC	*Washington Administrative Code*
WIDS	Waste Information Data System

1 Introduction

This document is Addendum 4 to DOE/RL-2008-46, *Integrated 100 Area Remedial Investigation/ Feasibility Study Work Plan*, hereafter referred to as the Integrated Work Plan. This addendum describes 100-F/IU-2/IU-6 and planned efforts to conduct a remedial investigation (RI) and feasibility study (FS) in support of a final record of decision (ROD) for the 100-FR-1, 100-FR-2, 100-IU-2, and 100-IU-6 Source Operable Units (OUs), and the 100-FR-3 Groundwater OU. Figure 1-1 presents the relationship between the RI/FS work plan and this addendum.

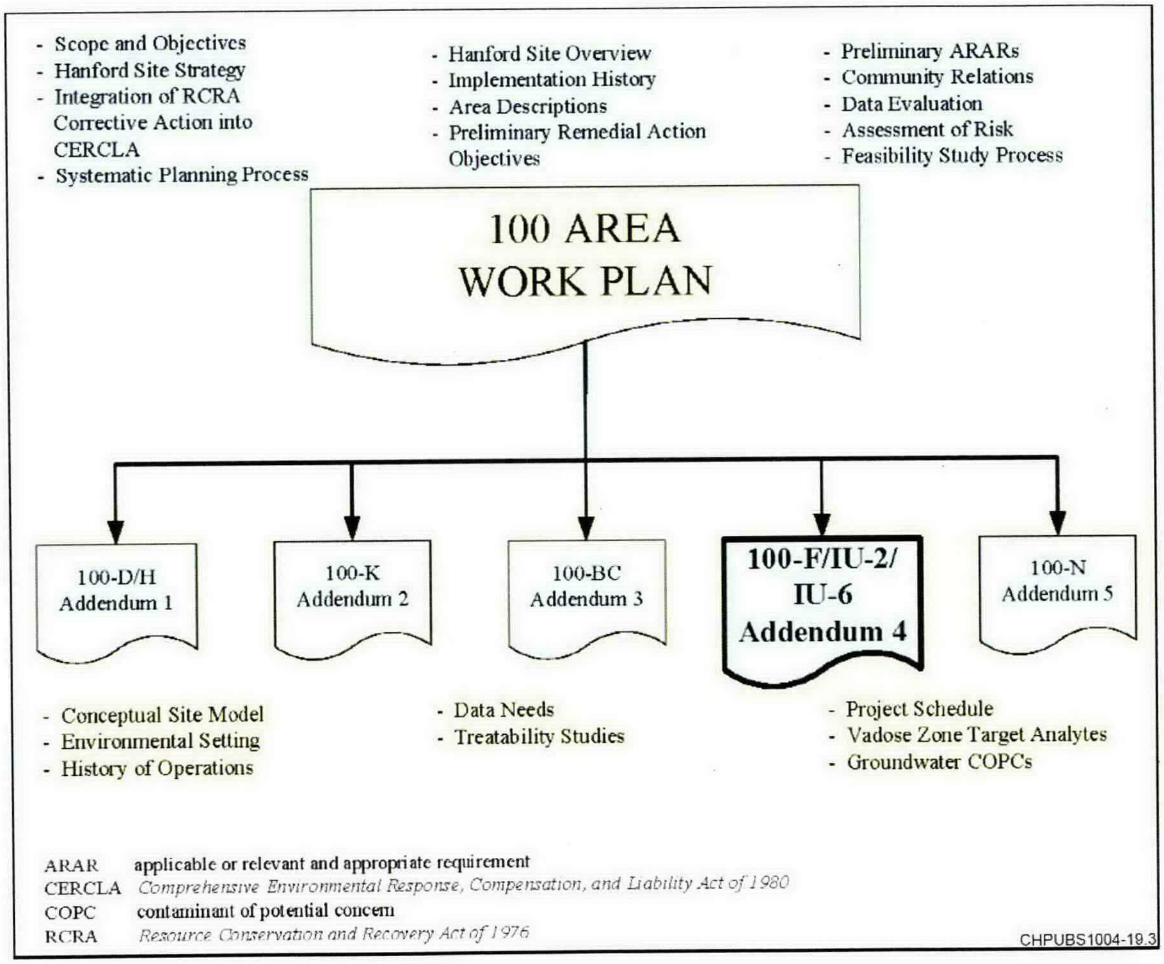


Figure 1-1. Relationship between the Work Plan and the Addenda

This addendum was developed through multiple interview sessions, workshops, and task teamwork organized through the Systematic Planning Process with the participation of subject matter experts.

The following sections of the Integrated Work Plan (DOE/RL-2008-46) are included by reference:

- Assessment of Baseline and Residual Risks in the 100 Area (Section 3.6)
- Preliminary Remedial Action Objectives (Section 4.1)
- Preliminary Remediation Goals (Section 4.2)
- Potential Applicable or Relevant and Appropriate Requirements (Section 4.3)
- Preliminary Remedial Actions (Section 4.5)

1.1 Scope

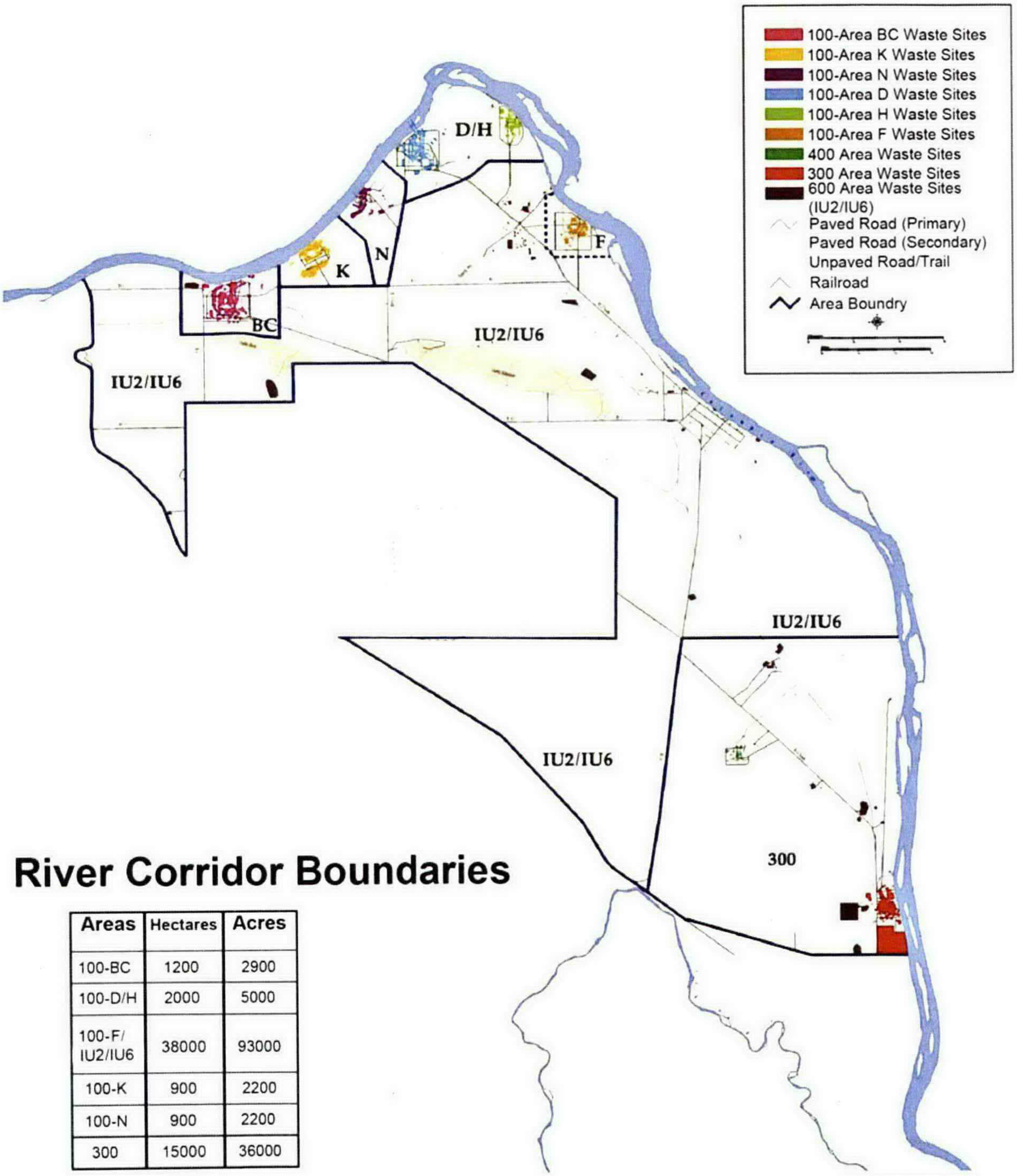
The Integrated Work Plan (DOE/RL-2008-46) contains the planning elements that are common to all of the Hanford Site 100 Area source and groundwater OUs, and a summary of the RI/FS tasks. This addendum addresses the data and information needed to support the groundwater and waste site RI/FS associated with 100-F/IU-2/IU-6. The 100-F area encompasses the F Reactor operating region and includes the 100-FR-1 and 100-FR-2 source OUs, and the 100-FR-3 groundwater OU. The IU-2 and IU-6 source OUs cover a large area outside of Hanford's primary reactor operating areas. Figure 1-2 shows the location of 100-F and IU-2/IU-6 and their proximity to other 100 Area OUs.

Data gaps significant to making remediation decisions are addressed through additional data collection and other investigations. Chapter 2 provides the background and environmental setting information necessary to support the development of the 100-F/IU-2/IU-6 Conceptual Site Model (CSM). Chapter 3 discusses the initial evaluation and CSM components. The CSM is a useful tool to guide characterization and identify effective remediation actions. A CSM is a representation of the site that organizes the information available and summarizes the site conditions. More importantly, a CSM can be used to identify data gaps and establish the programmatic priority for sampling and testing hypotheses.
In Chapter 4, the work plan rationale and associated tasks are discussed. The general project schedule is included in Chapter 5.

The identification of data needs led to development of a sampling and analysis plan (SAP) that establishes characterization activities specific to 100-F/IU-2/IU-6. The SAP (DOE/RL-2009-43, *Sampling and Analysis Plan for the 100-FR-1, 100-FR-2, 100-FR-3, IU-2, and IU-6 Operable Units Remedial Investigation/Feasibility Study*) includes a field-sampling plan that provides the sampling strategy and techniques that will be used to obtain the supplemental data required for the RI/FS. The SAP also provides a quality assurance project plan to ensure that the data collected meet the appropriate quality assurance and control requirements.

1.2 100-F/IU-2/IU-6 Remediation Accomplishments

Extensive environmental remediation and restoration activities have been completed and more are planned at the Hanford Site. These remediation activities, many of which are ongoing, have achieved significant cleanup progress across the site. These activities include characterization of groundwater plumes and their potential vadose zone sources, cleanup of the groundwater and soil, and testing of new and alternative treatment methods specific to the issues and contaminants at the Hanford Site.



Areas	Hectares	Acres
100-BC	1200	2900
100-D/H	2000	5000
100-F/ IU2/IU6	38000	93000
100-K	900	2200
100-N	900	2200
300	15000	36000

Figure 1-2. River Corridor Area Boundaries

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2 Environmental Setting and Site Background

This section describes the background, history, and environmental setting of 100-F/IU-2/IU-6 and includes information on the wastes generated and known and potential contamination. Between 1943 and 1963, nine plutonium production reactors were built along the Columbia River at the Hanford Site. Their core function was to produce special nuclear materials for the national defense system, with support from ancillary and associated infrastructure capabilities. The F Reactor is located in 100-F. The surrounding large open expanses of the River Corridor included scattered support facilities and the former townsites of Hanford and White Bluffs (shown in Figure 2-1) and comprises the 100-IU-2 and 100-IU-6 OUs. This information was used to guide the development of the SAP (DOE/RL-2009-43) and the conceptual site model discussed in Chapter 3.

The information for 100-F in this section is derived primarily from WHC-SD-EN-TI-169, *100-F Reactor Site Technical Baseline Report Including Operable Units 100-FR-1 and 100-FR-2;* and UNI-946, *Radiological Characterization of the Retired 100 Areas.* Principal sources used to describe the operations and facilities in the 100-IU-2 and IU-6 OUs include BHI-00448, *White Bluffs, 100-IU-2 Operable Unit Technical Baseline Report*; BHI-00146, *100-IU-6 Operable Unit Technical Baseline Report*; EPA/ROD/R10-99/039, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington*; and DOE/RL-95-108, *Approach and Plan for Cleanup Actions in the 100-IU-2 and 100-IU-6 Operable Units of the Hanford Site.*

2.1 Environmental Setting

Portions of the Hanford Site are designated numerically, with the location of production reactors being the 100 Area. The 100 Area is located in the northern part of the Hanford Site along the south shore of the Columbia River. The 100 Area is divided into five areas, each of which is composed of source and groundwater OUs (Figure 1-2). Environmental setting information common to the 100 Area is provided in detail in the Integrated Work Plan (DOE/RL-2008-46). The environmental setting dictates much of the behavior of contamination within the vadose zone and groundwater.

The 100-F/IU-2/IU-6 OU is located in the northern portion of the Hanford Site adjacent to the Columbia River. Numerous environmental, geologic, and hydrogeologic investigations have been conducted in 100-F/IU-2/IU-6. The following sections summarize the findings of these investigations specific to 100-F/IU-2/IU-6 and the factors that affect contamination impacts at the Hanford Site.

2.1.1 Topography

The topography of the reactor area is relatively flat inland from the Columbia River, with elevations generally between 120 and 130 m (395 and 425 ft) above mean sea level. Topography changes are greatest near the river where surface elevations drop to approximately 116 m (380 ft) above mean sea level. The area has been disturbed and graded extensively since reactor construction began in the 1950s through present-day waste site remedial activities. The topography within the area outside of the reactor areas varies widely. This region is relatively flat with areas of sand dunes, but also includes Gable Butte and Gable Mountain. These features are the highest land forms within the Hanford Site, rising approximately 60 m (200 ft) and 180 m (590 ft) above surrounding land, respectively (HNF-35051, *Small Water Systems Management Program for Group A Water Systems Managed by Fluor Hanford*, page B-1).

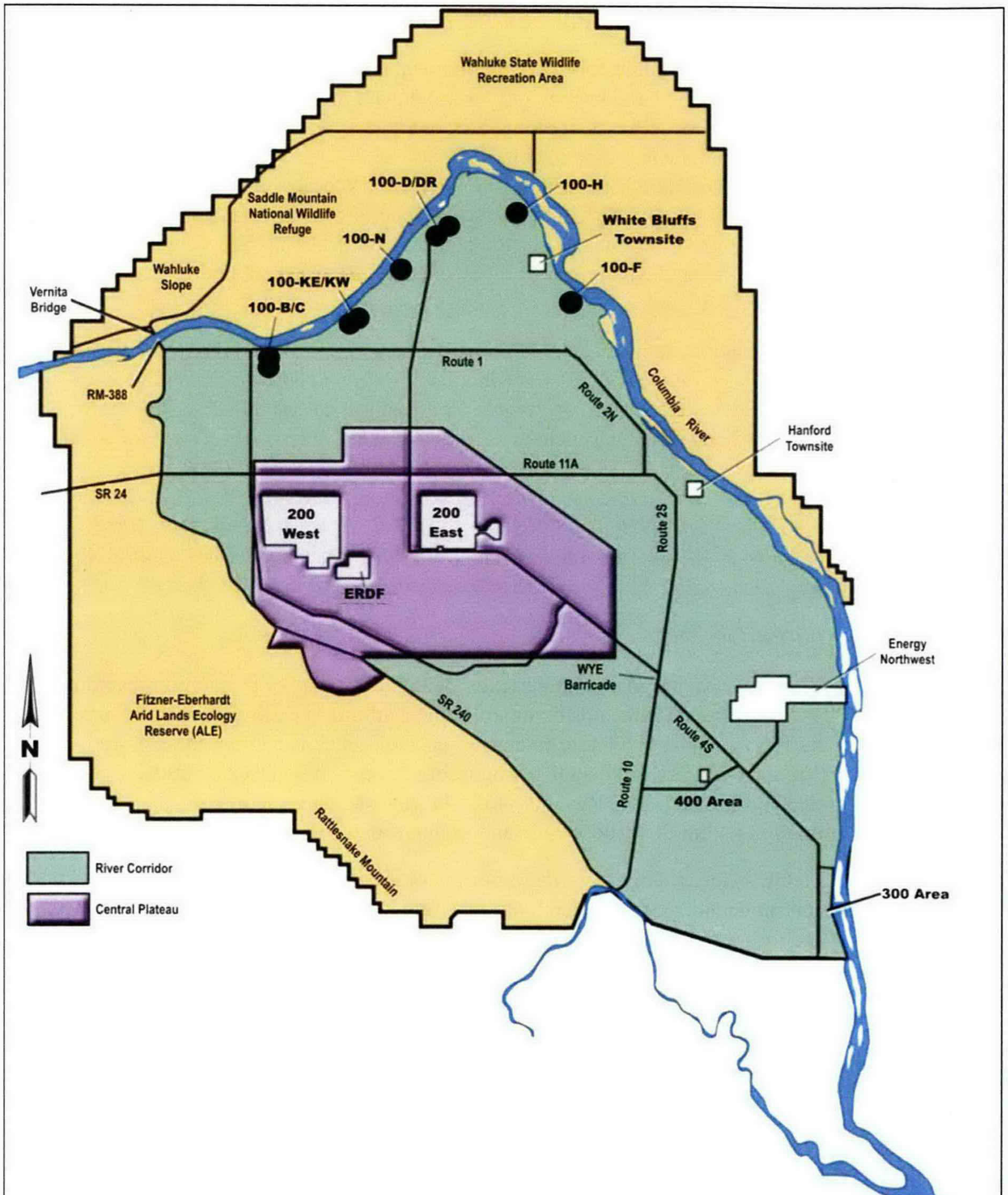


Figure 2-1. General Location of Features

The landscape is dominated by a semiarid (steppe) environment with a sparse covering of cold-desert shrubs and drought-resistant grasses. This landscape supports occasional small, wetland-like features affected by drainage from infrastructure, facilities, and past development. Numerous infrastructure features are present including pipelines, a reactor building, former waste sites, and groundwater monitoring systems and equipment.

2.1.2 Geology

100-F/IU-2/IU-6 is underlain by Miocene-aged (approximately 17 to 8.5 million years old) basalt of the Columbia River Basalt Group and late Miocene-to Pleistocene-aged supra basalt sediments (approximately 10.5 million to 12,000 years old). The Columbia River Basalt Group is greater than 3,000 m (9,800 ft) thick. The sediments that overlie the basalts are divided into two main units: the Ringold Formation of late Miocene to middle-Pliocene age (approximately 10.5 million to 3 million years old present) and the Hanford formation of Pleistocene age (approximately 1 million to 12,000 years old).

Discontinuous deposits of the Cold Creek unit separate the Ringold Formation Unit E and the Hanford formation in portions of the site near the 200 West and 200 East Areas. Holocene deposits and backfill of silt, sand, and gravel form a relatively thin veneer at the surface. Figure 2-2 provides a generalized cross-section of the strata observed throughout the 100 Area.

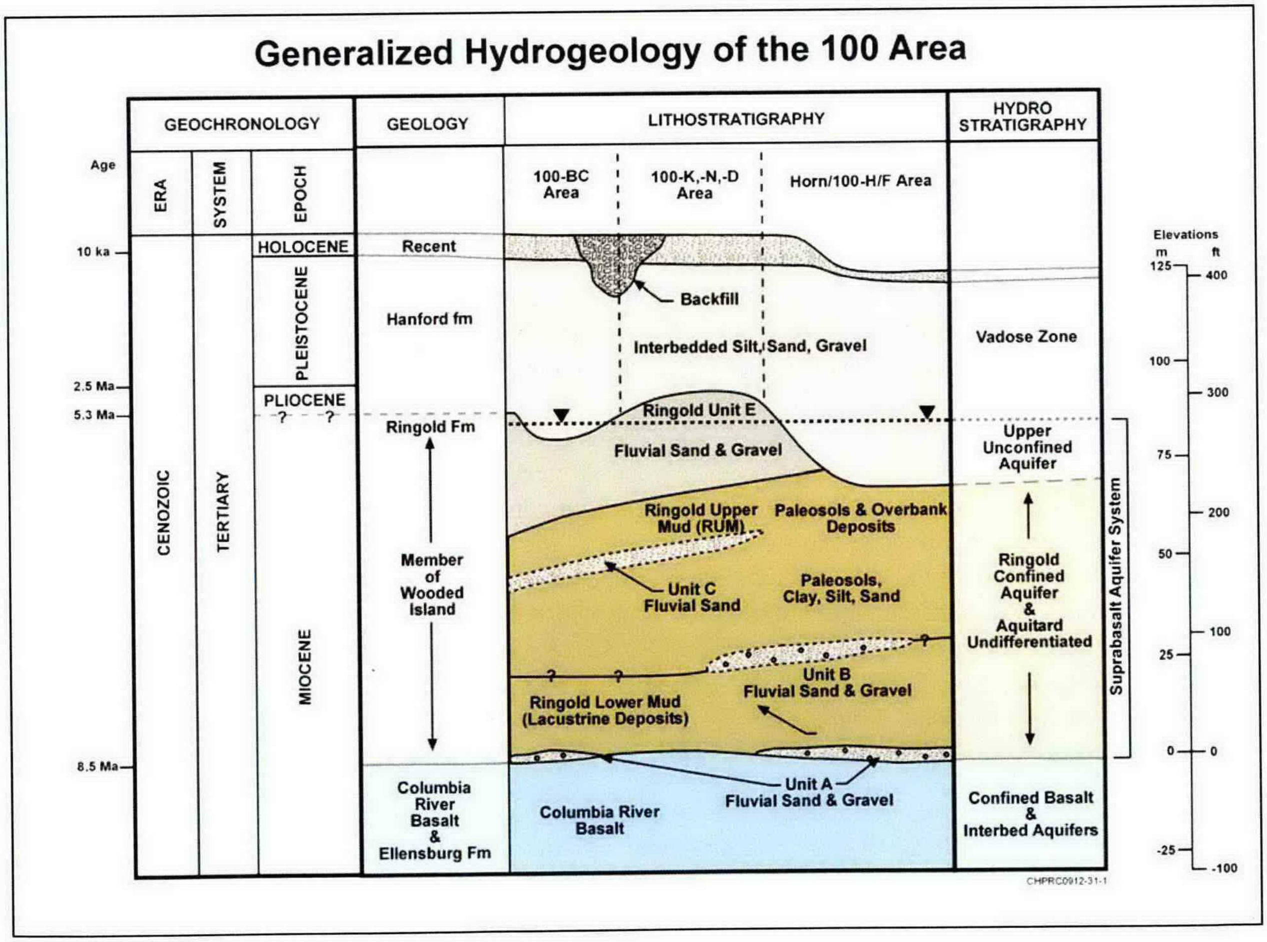


Figure 2-2. Generalized Hydrogeology of the 100 Area

2.1.2.1 Ringold Formation

The Ringold Formation lies directly above the Columbia River Basalt Group. The Ringold Formation was formed by fluvial-lacustrine (stream-lake) processes. The Ringold Formation is composed of units of non-indurated and semi-indurated (loose to semi-hardened) clay, silt, fine to coarse-grained sand, and granule to cobble-size gravel. The Ringold Formation Units that are the focus of contamination are the Ringold Formation Unit E and the Ringold Formation Upper Mud (RUM) Unit. Deeper Ringold Formation Units (e.g., Unit B, Lower Mud) are also present in the area.

The RUM Unit is a silt and clay-rich unit that is substantially less permeable than the overlying units and is considered an aquitard rather than an aquiclude (completely impermeable layer). It spans a thickness of approximately 34 to 38 m (100 to 125 ft) from 100-BC (199-B3-2) to the western edge of 100-F (WHC-SD-EN-TI-221, *Geology of the 100-FR-3 Operable Unit, Hanford Site South-Central Washington*). Within 100-F, the Ringold Formation has been penetrated by as much as 46 m (150 ft) in well 100-F5-43B, which is located adjacent to 100-F5-43A (WHC-SD-EN-TI-221). The RUM Unit forms the base of the unconfined aquifer in the 100 Area, away from the influences of ridge structures such as Gable Mountain and Gable Butte. On the flanks of such ridges, the basalts of the Columbia River Basalt Group form the base of the unconfined aquifer. The hydraulic conductivity of the RUM Unit in this area is not known. The surface topography of the RUM Unit may be a significant factor affecting contaminant fate and transport. The RUM Unit was scoured by river channel migration and glacial flood erosion that ultimately laid down the Hanford formation, resulting in an undulating surface.

The Ringold Formation Unit E is composed of sequences and interbeds of sand, sand and gravel, and gravel. The Ringold Formation Unit E typically consists of fluvial gravels with lesser amounts of sand, silt, and clay, with areas of local cementation. At 100-F, Ringold Formation Unit E has been completely eroded by late-stage catastrophic flooding (WHC-SD-EN-TI-023, *Hydrologic Information Summary for the Northern Hanford Site*). Conversely, the vadose zone includes the upper portion of the Ringold Formation Unit E where it is exposed along the Columbia River at the western portion of 100-F/IU-2/IU-6 near 100-K. At the westernmost portion of the Hanford Site, Unit E is present up to a thickness of more than 40 m (130 ft) (WHC-SD-EN-TI-133, *Geology of the 100-B/C Area, Hanford Site, South-Central Washington*). The Ringold Formation Unit E pinches out against the flanks of Hanford Site ridges, and thins eastward until it disappears west of 100-F.

2.1.2.2 Cold Creek Unit

The fine-grained portions of the Cold Creek Unit can influence contaminant migration by slowing its rate of downward movement and potentially diverting contaminants laterally (Slate, 1996, "Buried Carbonate Paleosols Developed in Pliocene-Pleistocene Deposits of the Pasco Basin, South-Central Washington, U.S.A."). Cold Creek Unit alluvial materials have deposited between the Ringold Formation and Hanford formation in the interior region, but are not present in 100-F (WHC-SD-ER-TI-003, *Geology and Hydrology of the Hanford Site: A Standardized Text for Use in Westinghouse Hanford Company Documents and Reports*; PNNL-13858, *Revised Hydrogeology for the Suprabasalt Aquifer System, 200-West Area and Vicinity, Hanford Site, Washington;* DOE/RL-2002-39, *Standardized Stratigraphic Nomenclature for Post-Ringold Formation Sediments Within the Central Pasco Basin*).

The Cold Creek Unit's five facies range from fine-grained, laminated to massive, fluvial overbank sediments, to coarse-grained, basaltic or multi-lithic, alluvium, and colluvium (DOE/RL-2002-39). The thickness of the Cold Creek Unit ranges up to 20 m (66 ft). However, its thickness and sediment types are highly variable and discontinuous (DOE/RL-2002-39).

2.1.2.3 Hanford Formation

Throughout 100-F/IU-2/IU-6, the Hanford formation overlies the Ringold Formation. The Hanford formation is characterized by large to very large cobble to boulder size clasts in open framework gravels that include discrete sand lenses, with minor to no silt and clay material. The grains typically are sub-round to round gravel and sub-angular to round in the sand grain fraction. The gravel-dominated facies is typically well stratified and contains little to no cementation (WHC-SD-EN-TI-132, *Geologic Setting of the 100-HR-3 Operable Unit, Hanford Site, South-Central Washington*).

The Hanford formation beneath the 100-FR-3 OU varies in thickness from approximately 8 m (25 ft) in well 199-F7-1 to approximately 24 m (80 ft) in well 199-F5-2 (WHC-SD-EN-TI-221). The Hanford formation (an unofficial designation) consists of gravel, sand, and silt deposited by cataclysmic flood waters that drained out of glacial Lake Missoula during the Pleistocene age (DOE/RW-0017, *Draft Environmental Assessment: Reference Repository Location Hanford Site, Washington*).

The Hanford formation is divided into three facies: (1) gravel-dominated, (2) sand-dominated, and (3) silt-dominated (DOE/RL-2002-39). The Hanford formation comprises the dominant material throughout the 100 Area vadose zone where numerous contaminant sources either have been remediated or await remediation.

2.1.2.4 Hanford/Ringold Contact

The top of the Ringold Formation within 100-F generally dips toward the Columbia River (WHC-SD-EN-TI-221). Below 100-F, the Ringold Formation Unit E is absent, and the contact between the Hanford formation and Ringold Formation occurs at the RUM Unit.

The contact between the Ringold Formation Unit E and the Hanford formation is important in the remainder of the area because the saturated hydraulic conductivity for the gravel-dominated sequence of the Hanford formation is generally one to two orders of magnitude higher than the more compacted and locally cemented Ringold Formation Unit E. Since hydraulic conductivity varies with the formation, different groundwater responses may occur where channels now filled with the Hanford formation have been scoured into the Ringold Formation Unit E. These buried channels may serve as preferential pathways for contaminated groundwater during high river stages (PNNL-14702, *Vadose Zone Hydrogeology Data Package for Hanford Assessments*).

Hanford formation gravels overlie Ringold Formation Unit E gravels beneath the western portions of the area. The Hanford formation is often difficult to differentiate from the Ringold Formation Unit E. The units are differentiated based on characteristics such as a basalt clast content, gravel content, coloration, and cementation. The Hanford formation typically is less cemented than the Ringold Formation and has greater gravel content, but cable tool drilling can disrupt the integrity of these features. The sand fraction in Hanford formation gravels generally contains greater than 40 percent basalt as compared to Ringold Formation deposits that generally contain less than 25 percent basalt (WHC-SD-EN-TI-132). Hanford formation gravels may display salt-and-pepper and gray coloring, while Ringold Formation gravels are generally more oxidized and reddish-brown to yellow-red in color.

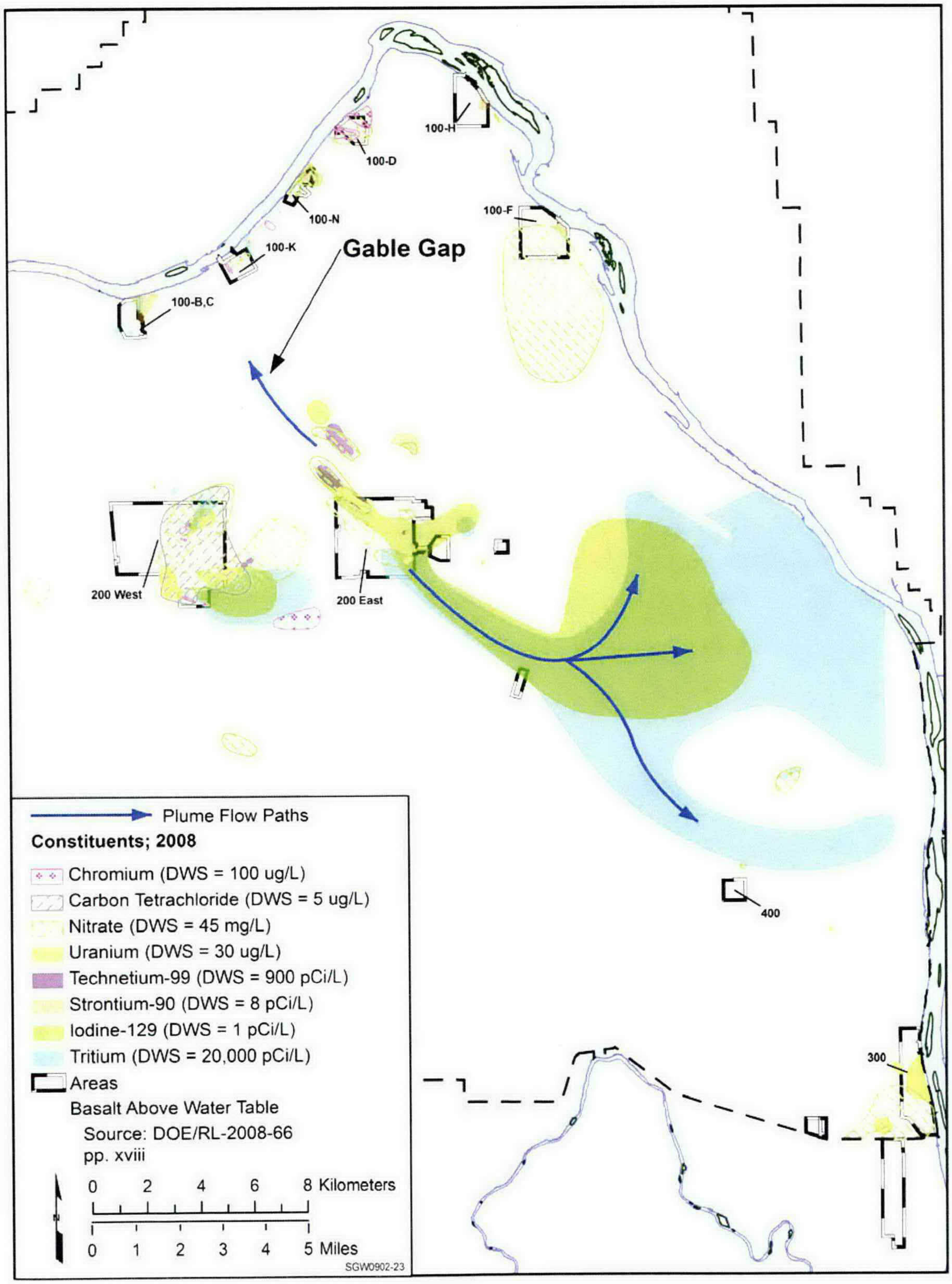


Figure 2-3. 100-F/100-IU-2/IU-6 Contaminant Plumes and Flow Paths

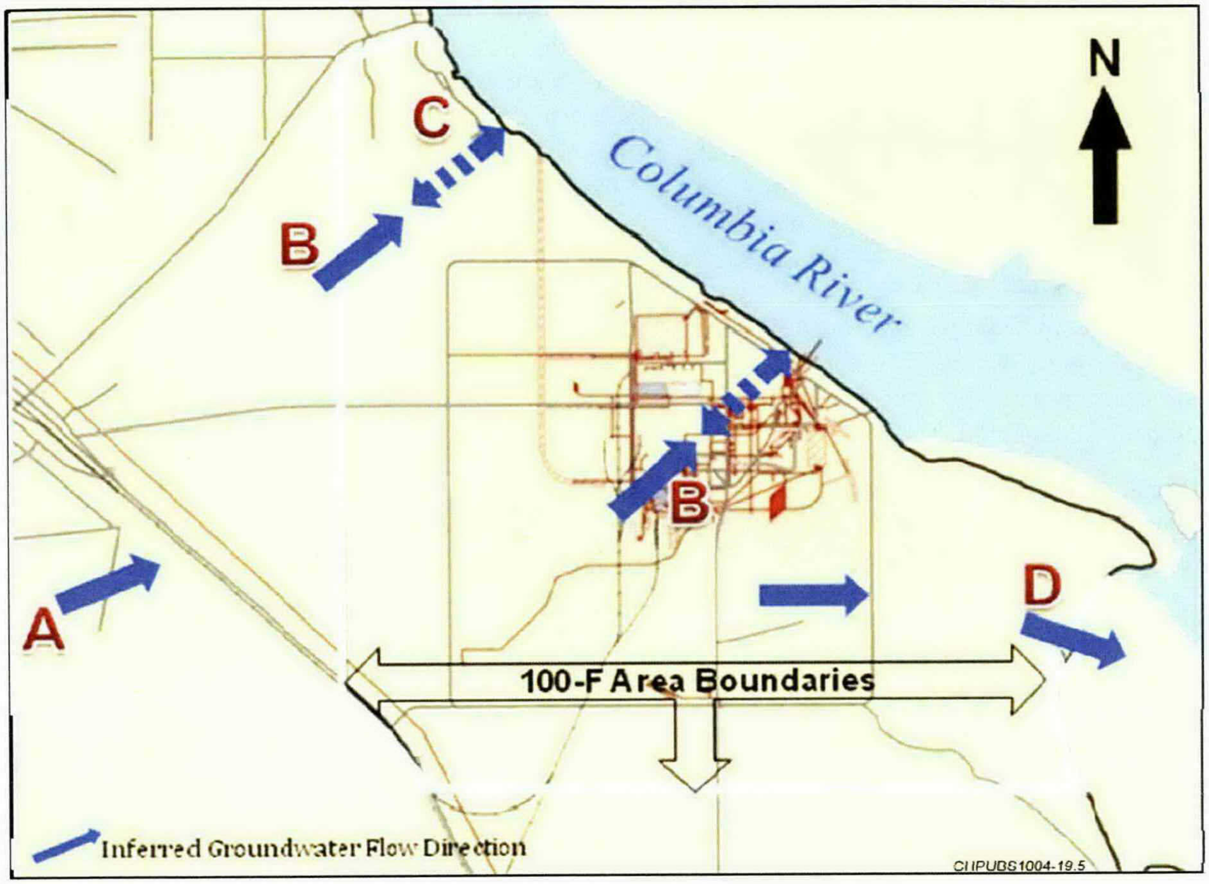


Figure 2-5. Simplified Groundwater Movement at 100-F
(A: Inland; B and D: During Low to Moderate River Stage; and C: During High River Stage)

2.1.3.2 Hydrogeologic Properties

Hydraulic properties (e.g., hydraulic conductivity) control the aquifer response to fluctuating river stage, groundwater flow, and therefore, contaminant transport in groundwater (PNNL-13674, *Zone of Interaction Between Hanford Site Groundwater and Adjacent Columbia River: Progress Report for the Groundwater/River Interface Task Science and Technology Groundwater/Vadose Zone Integration Project*). Those contaminants that are not strongly adsorbed onto the soil matrix may also migrate through the vadose zone to groundwater. Large releases of contaminated water to retention basins and liquid waste disposal facilities were the responsible driving forces behind the migration, with contaminants in these releases ultimately reaching the river (PNL-8337, *Summary and Evaluation of Available Hydraulic Property Data for the Hanford Site Unconfined Aquifer System*). Strongly sorbing contaminants are retained on sediments at or near their discharge points (PNNL-SA-53273, *Hanford Site Vadose Zone Studies: An Overview*). Further chemistry changes result from constant soil re-wetting from seasonal and diurnal river stage changes, with greatest influence nearest the river. A high river stage can cause the water table to rise into the periodically re-wetted zone, where it comes into contact with sediment that may contain higher concentrations of contaminants (PNNL-13674).

The results of 1992 and 1993 hydraulic conductivity tests in various area wells indicates hydraulic conductivities ranging from less than 0.00035 to more than 1.76 cm/sec (1 to more than 5,000 ft/day) with most results falling between 0.0035 to 0.071 cm/sec (10 and 200 ft/day), as reported in PNL-8337. The lower hydraulic conductivities were reported for those wells that are screened in sediments with greater silt content (WHC-SD-EN-TI-221). At an assumed effective porosity of 0.1 to 0.3, the groundwater flow rate ranges from 0.06 to 1.4 m/day (0.2 to 4.6 ft/day). Studies are ongoing to evaluate the physical and chemical characteristics of vadose zone and saturated zone strata and to assign hydrologic properties to each sediment type for modeling purposes.

2.1.3.3 Recharge

Natural and artificial recharge are key drivers of the mobilization of contaminants in the vadose zone, and ultimately groundwater. Over the past 25 years, natural recharge has averaged more than 6 cm (2.4 in.) per year (approximately one-third of the annual precipitation) as measured at one of the many Hanford lysimeter sites (PNNL-SA-53273).

The most significant recharge sources are episodic meteorological events (i.e., storms and rapid snowmelts) (PNNL-14744, *Recharge Data Package for the 2005 Integrated Disposal Facility Performance Assessment*), while dust suppression during construction and source remediation activities also plays a role in contaminant transport. Recharge rates vary seasonally with the majority occurring in the winter and spring.

2.1.4 Human Resources

Cultural and historical information specific to 100-F/IU-2/IU-6 is included in this section.

2.1.4.1 Prehistoric Archaeological Resources

According to Relander (*Drummers and Dreamers*, 1986), a nearly continuous string of camps and villages extended from the just northwest of 100-F, to downriver of the Hanford Townsite. Radiocarbon dates obtained from these sites document a range of occupation extending nearly 9,000 years into the past. For example, the 45BN431 Complex, adjacent to the Columbia River northeast of 100-F, is a multi-component site. Eleven radiocarbon dates provide a range of occupation extending from 8,860 to 270 radiocarbon years old; however, five of these dates cluster between 630 and 270 years, indicating an emphasis on relatively recent occupation(s) for this extended, linear shoreline site. Analysis of the artifacts and features found at this site indicates it was used as a seasonal camp devoted primarily to shellfish, fish, mammal, and plant procurement and processing (Marceau and Sharpe, 2006, *Archaeological Activities Report: Post Review Discoveries within 45BN431 at Solid Waste Site 128-F-2*).

Further downriver, as recorded in 1968, site 45BN118 consisted of 18 to 24 house pits and associated artifacts including cobble tools and hopper mortars. The site was considered to be a large, open-air camp/village (Rice, 1968, *Archaeological Reconnaissance: Ben Franklin Reservoir Area, 1968*). This site was determined to be a contributing element to the Savage Island Archaeological District, listed on the National Register of Historic Places in 1976. However, by 1989, surface evidence of the house pits was lacking, but fire-cracked rock, a few flakes, anvil stones, bits of fish and mammal bones, and mussel shell fragments were observed in an area extending along the shoreline. The shell layers were described as extending from 1 m to more than 2 m (3.3 to more than 6.6 ft) below the surface (PNL, 1989, *Archaeological Site Monitoring Form: 45BN118*). By 2001, the site had become overgrown with grasses and bushes such that only two possible house pits were located, with none of the previously recorded artifacts observed (PNNL, 2001, *Archaeological Site Monitoring Form: 45BN118*).

A fire occurred at the 45BN118 site in 2004. During post-fire monitoring conducted in 2004, surface artifacts were noted again at 45BN118, mostly on the sandy terrace along the length of the site (PNNL, 2004, *Archaeological Site Monitoring Form: 45BN118*). This site provides a case study of the effects of wind deposition of fine-grained eolian sands over the past 40 years. This natural process has likely buried the surface manifestations of this village site under a mantle of soil approximately 0.5 to 1 m (1.6 to 3.3 ft) thick, a process accelerated by the loss of surface vegetation due to the 2004 fire. Although artifacts may not be visible at the site, they may still be present.

2.1.4.2 Traditional Cultural Resources

Cemeteries associated with the Wanapum are known to be in the vicinity of 100-F.

2.1.4.3 Historic-Archaeological Resources

The principal historic-archaeological sites associated with 100-F are the White Bluffs and Hanford townsites. The White Bluffs ferry landing was the upriver terminus of shipping during the mid-19th century. It was at this point that supplies were transferred from riverboats to wagons. The first store and ferry in the mid-Columbia were located at White Bluffs (ERTEC, 1981, *Cultural Resources Survey and Exploratory Excavations for the Skagit-Hanford Nuclear Power Project*). The only structure associated with White Bluffs that still remains is the First Bank of White Bluffs, a National Register property. The Hanford townsite, located a short distance downriver, is manifested by two surviving structures: the Hanford High School and the Hanford Electrical Substation-Switching Station. Both structures have been determined eligible for listing in the National Register of Historic Places. These two communities were the anchoring points for the agricultural development extending along the "horn" of the Columbia River.

In December 1905, the Hanford Irrigation and Development Company organized in Seattle for the purpose of reclaiming 12,950 ha (32,000 ac) of arid land along the Columbia River near White Bluffs. By 1909, the 18-mile-long Hanford Irrigation Canal, determined eligible for listing in the National Register, was carrying water from the Allard Pump House near Coyote Rapids on the Columbia River to the communities of White Bluffs and Hanford. The Priest Rapids Valley soon became one of the premier orchard regions in the state. Farms were primarily family-operated and ranged in size from under 2 ha (5 ac) to more than 16 ha, averaging about 8 ha (40 ac and 20 ac, respectively). Hanford and White Bluffs farmers made large investments in their land, constructing irrigation systems and planting a variety of crops including apples, apricots, cherries, grapes, melons, peaches, pears, plums, strawberries, hops, alfalfa, asparagus, corn, and potatoes. Many farms had as many as eight fields dedicated to different crops.

Others, primarily orchardists, focused on a single crop. In 1913, settlement and agricultural development in the valley was bolstered by the construction of the Chicago, Milwaukee, St. Paul, and Pacific Railroad, which enabled the farmers to move from local to national markets. The small family owned farms that dominated the economy of Hanford and White Bluffs struggled during the Great Depression, but many of the farm families were able to supplement their livelihoods with barter and non-farm employment. By the early 1940s, conditions had started to improve. Wartime industries in eastern Washington and the construction of the Grand Coulee Dam and Columbia Basin irrigation projects provided a significant economic stimulus. However, the farming life in Hanford and White Bluffs came to an abrupt halt in 1943 when the U.S. government took possession of the land and removed the people from their homes (BHI-01326, *Pre-Hanford Agricultural History: 1900-1943*; PNNL-14562 *The Hanford and White Bluffs Agricultural Landscape: Evaluation for Listing in the Nation Register of Historic Places*). Remnants of the Priest Rapids Valley agricultural history are located throughout 100-IU-2 and 100-IU-6 OUs.

The Hanford Construction Camp ("Camp Hanford") that overlies the Hanford townsite and the workshops that lie east of White Bluffs comprise the most significant resources relating to the Manhattan Project in this area. The camp housed the workers and support services necessary to construct the Hanford Site, or Hanford Engineer Works (HEW), as it was known at the time. Originally envisioned for a work force of 25,000 to 28,000, with about half to be housed in surrounding communities, the camp grew to about 51,000 people at its peak in 1944 (HAN-10970, *Construction Hanford Engineer Works, U.S. Contract No. W-7412-ENG-1, DuPont Project 9536, History of the Project*). The U.S. Army Corps of Engineers constructed barracks, pre-fabricated hutments, and trailer parks between April 1943 and August 1944. "As the permanent plant work force progressed and the construction force increased, commercial and service facilities were expanded to meet the additional requirements. Eventually, Hanford included stores of sufficient variety and number to satisfy all the essential needs of the population" (HAN-10970). By late February 1945, the camp was abandoned. Within a year after the war ended, whatever remained of the camp was removed and the area leveled, leaving only the roadway grid and a few isolated foundations low enough to escape a bulldozer (DOE/RL-97-1047, *History of the Plutonium Production Facilities at the Hanford Site Historic District, 1943–1990)*. Three Manhattan Project or Cold War-era buildings have been inventoried in 100-F, including the F Reactor, which was the third Manhattan Project reactor to go critical on the Hanford Site. Eleven artifacts were tagged for preservation in the F Reactor. All of these artifacts have been transferred either to B Reactor or the Columbia River Exhibition of History, Science, and Technology for display or inclusion in the Hanford Collection.

2.2 100-F/IU-2/IU-6 Overview

The 100-F/ IU-2/ IU-6 can be divided into two primary areas of use: the 100-F Reactor area, and the IU-2 and IU-6 area. Table 2-1 summarizes the 100-F/IU-2/IU-6 area information. Appendix A provides maps of the areas. Appendices B and C provide descriptions of the waste sites and facilities, respectively, for each OU.

Table 2-1. 100-F/IU-2/IU-6 Area Information

Area or OU	Site Information
100-F Area	100-F is located downstream of 100-H and upstream of the 300 Area. The F Reactor and its associated infrastructure are located here. Source area OUs include 100-FR-1 and 100-FR-2.
Groundwater	The 100-FR-3 OU encompasses the groundwater beneath 100-F.
100-IU-2 and 100-IU-6	The 100-IU-2 and 100-IU-6 OUs include the Hanford and White Bluffs townsites and the inter-area regions that consist of large expanses of open land between and outside the various production areas (100, 200, 300 and Areas).
Groundwater	Groundwater contamination migrating into 100-F/IU2/IU6 from 200-PO-1 and 200-BP-5 OUs, within the 200 East Area, are not part of this RI/FS.

Note:

OU = operable unit

RI/FS = remedial investigation/feasibility study

2.2.1 100-F Area

100-F includes the area around the F Reactor, the 100-FR-1 and 100-FR-2 source OUs, and the 100-FR-3 groundwater OU. Construction of the F Reactor (105-F) began in December 1943. The facility was completed in February 1945 and activated later that month after comprehensive equipment testing. The F Reactor was the third of three original Hanford reactors built during World War II as part of the Manhattan Project. Operations were initially conducted at 265 megawatts and over time gradually increased to a final level of 2,090 megawatts in 1961. The F Reactor continued operating at the reactor's maximum authorized power level from 1961 until it was deactivated in 1965. Figure 2-6 shows 100-F during the production years.

Figure 2-6. Aerial View of 100-F Area During Production (1962)

The F Reactor was supported by multiple facilities associated with services for water treatment, air filtration, nuclear fuel handling, effluent disposal, and laboratories, with various other administrative buildings (WHC-SD-EN-TI-169). With regard to soil and groundwater contamination, these services generated various wastes that were either discharged to the river; directed to unlined cribs, trenches, or another engineered structures; or buried in unlined burial grounds onsite.

After its war-time production effort, the graphite pile at F Reactor was in the "worst shape of the World War II reactors," from neutron-induced graphite distortion and was "the last pile on which any risk should be taken at present," with regard to experiments directed toward increasing operational power and production in the reactors (WHC-SD-EN-RPT-004, *Summary of 100 B/C Reactor Operations and Resultant Wastes, Hanford Site*, pp.21-24). However, it maintained operations after the war ended. Using subsequent improvements in technologies and processes tested and proven at the D Reactor in 1949, these changes were applied to the F Reactor, allowing its continued operation, with gradual increases in power and production until its mission ended.

Initial deactivation activities began at 100-F in 1965. This area was the first to be declared excess following the shutdown of its production reactor. Follow-on housekeeping and decommissioning activities began as part of a site-wide initiative in 1973, after deactivation of the remaining 100 Area single-pass reactors. This activity progressed, as resources allowed, from 1977 through 2003, with demolition of buildings, salvage or redeployment of surplus equipment, and maintenance of operations at a minimal level. The deactivation, decommissioning, decontamination, and demolition (D4) process removed facilities ranging from small mobile offices to highly contaminated multi-structured facilities, waste storage pads, sewage treatment structures, stacks, and tanks.

Once the plutonium production and other missions at the reactors ended, a ROD for the decommissioning of eight surplus production reactors at the Hanford Site was issued by the U.S. Department of Energy (DOE) (58 FR 48509, "Record of Decision: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington") to place the reactor in the F Area into interim safe storage (ISS) for up to 75 years. The ISS process for the F Reactor was completed in 2003 (Figure 2-7). The ISS process protects the reactor from environmental degradation and prevents the spread of contamination by providing an upgraded, weather-resistant shell to isolate the reactor core until final remedial activities are conducted. This action also minimizes the facility footprint by removing all peripheral reactor buildings and equipment and disposing of the debris. Ultimately, the reactor will be transported in one piece to a specially prepared burial facility in the 200 West Area of the Hanford Site. The only principal inactive structures remaining in the 100-F Area are the ISS reactor and the Pacific Northwest National Laboratory (PNNL) Outfall structures. Post-removal soil samples collected from each facility footprint verified that the removal or demolition activities met the D4 remediation objectives and goals.

Figure 2-7. Interim Safe Stored 105-F Reactor (2005)

2.2.1.1 Biological Testing and the Experimental Animal Farm

Each reactor area typically had a specific secondary mission that was dictated by the Hanford Site's general production stance. These secondary missions contributed specific waste management challenges for each reactor area that introduced variations from the initial common design and requirements, and increased the complexity of waste management operations. The secondary mission of the facilities at and around the F Reactor was a biological laboratory to examine the effects of radiation and radioactive contamination on plants, animals, and fish (WHC-SD-EN-TI-169).

Adjacent to the reactor site was the Experimental Animal Farm (EAF), which operated from 1945 to 1976 (Figure 2-8). Acute and lifetime exposure studies using a variety of isotopes (iodine-131, cesium-137, strontium -90, radium-226, and plutonium-239) were performed on animals including swine, sheep, dogs, cats, rodents, cows, chickens, and miniature goats at the EAF. Approximately 1,000 animals at a time were kept at the farm. These experiments produced contaminated solid and liquid wastes, including animal remains, dung, and urine that were disposed on site. Strontium-90 is of particular concern in this case because its concentrations remain elevated in groundwater above the drinking water standard.

Note: Shows original facility labels; circles indicate undisturbed animal pasture.

Figure 2-8. Experimental Animal Farm Holding Areas and Fish Ponds (1965)

The earliest animal experiments at the 100-F Area involved fish research at the 146-F Fish Laboratory in 1945. Fish research expanded around 1951 with the construction of 146-FR (Figure 2-9). The 146-F Fish Laboratory was then phased out and the building used for storage. Biological experiments with fish and other aquatic organisms continued at the 100-F Area until 1976 (Figure 2-10).

Fish were used to assess the effects of effluent discharge on aquatic life in the Columbia River. Twenty-year lifetime exposure studies of sheep, swine, cows, chickens, ducks, and miniature goats were performed, as well as experiments on the effects of ionizing radiation on beagles. Other experiments involving radioecology were conducted in greenhouses in 1705-F to determine the effects of ionizing radiation and radioactive contaminants on plants, both genetically and in the food chain. In addition, gardens located in the southwest corner of the 100-F Area were used for growing cereal grains, alfalfa, and other crops in soil containing controlled amounts of Sr-90 and cesium-137. A 4 ha (10 ac) pasture in the vicinity of the strontium gardens was used to keep pregnant animals and animals too young for experimental activities (DOE/RL-91-53, *Remedial Investigation/Feasibility Study Work Plan for the100-FR-3 Operable Unit, Hanford Site, Richland, Washington*). At the end of their operational life, these facilities were deactivated, decontaminated, decommissioned, and often demolished in place.

Figure 2-9. Construction of 146-FR

Note: Radiological posting.

Figure 2-10. Fish Tanks in One of the Biological Laboratories

Disposal of solids ranged from burial of solid animal wastes similar to other contaminated materials (e.g., packaging in plastic, boxes, or drums) in burial grounds to incineration and burial of animal remains. Disposal methods for these wastes varied widely, depending on their activity and amount. Liquid wastes were discharged with other laboratory wastes to liquid waste disposal sites.

The 108-F Building (Figure 2-11) was originally a chemical make-up facility and reactor laboratory (1945 through1948) supporting the F Reactor. It was the main chemical pumphouse that provided water treatment corrosion control, with a layout similar to those at the B and D Reactors. That task at the F Reactor was moved and the building remodeled to serve as the main biology laboratory facility at about the same time as the water treatment mission was moved or consolidated at the other original production reactors (1948 through 1949).

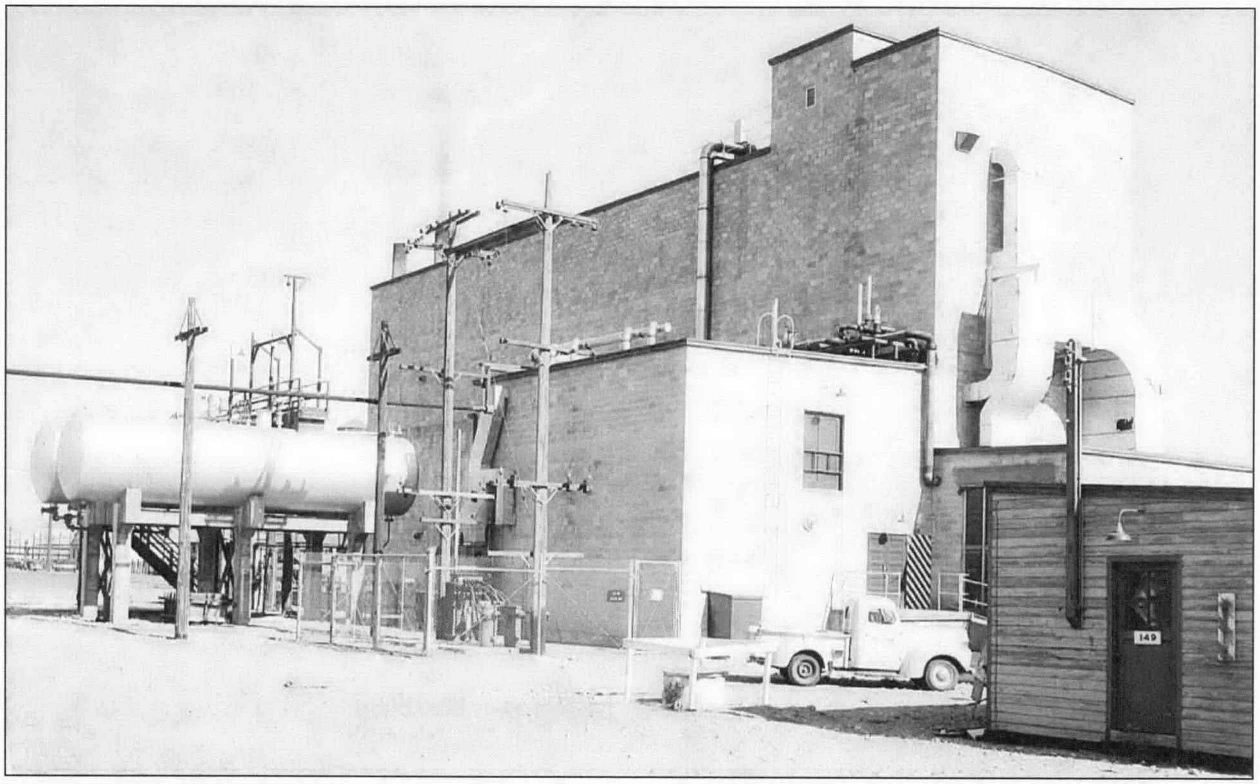


Figure 2-11. 108-F Laboratory Facility (1954)

After remodeling in 1949, a large-scale biology mission studying the effects of radiation on various organisms commenced at Building 108-F around 1950. Experiments ranged from using animals to determine health effects on nuclear workers to tests for the military (Gerber, 2007, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site*). This mission continued until 1973, when biological experiments and testing performed at Building 108-F were transferred to the 300 Area.

This facility and others that were re-purposed once the reactor was shut down had dedicated disposal sites for contaminated animal or plant experiment wastes in addition to those in place suitable for dual use. Building 108-F went through a housekeeping program in 1977 to remove highly contaminated material, with additional decontamination conducted in 1983 (BHI-01399, *108-F Biological Laboratory D&D Project Closeout Report*). Demolition of the facility was completed in 1999.

After reactor operations at 100-F ceased in 1965, animal research operations assumed the office buildings and maintenance shops previously associated with the F Reactor until 1976 (EGG-1183-1661, *An Aerial Radiological Survey of the U.S. Energy Research and Development Administration's Hanford Reservation [Survey Period: 1973-1974]*). Building 1707-F was converted for use as a dog inhalation laboratory. The 1707-FA building was converted for use as a rodent inhalation laboratory. Building 1713-F was used as a pathology laboratory, and the 1719-F building was converted for use as an animal care facility. Small animals were housed in the 1701-FA building (DOE/RL-91-53).

2.2.2 100-IU-2/100-IU-6

Sites and facilities in 100-IU-2 and IU-6 OUs were largely used for housing and staging equipment and material for the project, and were previously homestead farms. The area includes roads, railroads, fire station, an old concrete batch plant site, contaminated storage vaults in the east end of Gable Mountain, and pre-Hanford farm sites and landfills (e.g., pre-1943 municipal and farm waste sites), and abuts part of the Arid Lands Ecology Reserve including Rattlesnake Mountain. Contamination in this area generally originated from light industrial chemical use and agriculture, rather than nuclear material production and chemical processing. Several groundwater contaminant plumes (e.g., tritium, iodine-129) observed within 100-IU-2/ IU-6 originate from other areas, such as the Central Plateau. Data collection and remediation decisions for these plumes are addressed by the originating OUs (e.g., 200-BP-5 groundwater OU, 200-PO-1 Groundwater OU). The former Town of White Bluffs, the site of an agriculture based community of about 500 people that existed before the Manhattan Project era, is located in the 100-IU-2 OU. Many of the sites within the 100-IU-2 OU are remnants of that town and the surrounding farms. When the government took over the site, many of the houses were demolished and new temporary buildings such as blacksmith shops, receiving and storage warehouses, and offices were erected (BHI-00448). The White Bluffs area was the location of the central shops to support the Manhattan Project.

The Hanford townsite is located in the 100-IU-6 OU. Figure 2-12 shows the Hanford townsite in 1943 after the camp construction. During the life of the construction camp, 1,175 buildings, nine service facilities, and seven trailer camps were constructed. Following the termination of operations at the construction camp, a small force of patrol, fire, and boat repair personnel remained. In general, the sites within the 100-IU-6 OU include surface debris, oil spills, trash dumps, building foundations, surface depressions, and ash piles, either from the pre-Manhattan Project towns or activities of that era (BHI-00146). All portable hutments and trailers were dismantled and shipped offsite.

Figure 2-12. Hanford Townsite in 1943

Since 1943, all of the pre-Manhattan Project buildings on the Hanford townsite have been removed, with the exception of six structures—the Bruggemann Warehouse, Allard Pumping Station, White Bluffs Bank, Hanford High School, Hanford Electrical Substation/Switching Station, and a wall of a log cabin. With the exception of the Allard Pumping Station, all these structures are located within the 100-IU-2/IU-6 Area. These structures require no further action; therefore, they are not listed as facilities in the official Hanford Waste Information Data System (WIDS) database, which is the information source regarding known and suspected waste sites.

There were 14 facilities related to Manhattan Project or post-Manhattan Project activities. Most of these facilities were used to support laboratory activities, Hanford patrol activities, or communications. All have been demolished with the exception of 213 Plutonium Storage Receiving Vaults. Post-removal soil samples collected from each facility footprint verified that the removal or demolition activities met the D4 remediation objectives and goals.

2.2.3 Facility History and Description

Ninety-six facilities were used or constructed in 100-F/IU-2/IU-6. These facilities consist of the 105-F Reactor building, office and storage buildings, retention basins, a reactor stack, maintenance shops, process plants, electrical substations, storage tanks, pump stations, and outfall structures. Most of the facilities have a status of inactive, removed, or demolished (defined in the Integrated Work Plan). Table 2-2 provides summary information on the status of facilities. Appendix C provides a description and history of each facility.

Ninety-one of the 96 facilities have been demolished or removed. Table 2-2 defines the remaining facilities are classified as inactive or "to be determined" (i.e., needs to be verified). Facilities that were used during the operation of the reactors (the retention basin, reactor stack, office and storage buildings, maintenance shops, process plants, electric substation, storage tanks, and pump stations) make up most of the demolished or removed facilities.

Table 2-2. Summary of the Status of the Facilities in 100-F/IU-2/IU-6

Operable Unit	Total Number of Facilities	Demolished	Removed	To Be Determined	Inactive
100 F Area					
100-FR-1	73	66	3	2	2
100-FR-2	9	9	0	0	0
Total Facilities for 100-F Area	82	75	3	2	2
100-IU-2 and 100-IU-6 OUs					
100-IU-2	1	1	0	0	0
100-IU-6	13	12	0	0	1
Total Facilities for 100-IU-2 and 100-IU-6 OUs	14	13	0	0	1
Total					
Total Facilities for 100-F/IU-2/IU-6	96	88	3	2	3

Note:

This summary is current as of December 2009 (Stewardship Information System).

Reclassification Status

Demolished	=	Facility has been removed to grade (slab or foundation remains)
Inactive	=	Facility is no longer in use and awaiting decommissioning and demolition
Removed	=	Facility foundation has been removed and any substructure is 0.3 to 0.9 m (1 to 3 ft) below grade
To Be Determined	=	In the process of establishing facility status

Inactive facilities remaining within the 100-F Area include the 105-F Reactor building and the PNNL Outfall Structure. The Plutonium Storage Receiving Vault (Facility 213) is the only inactive facility still present in the remainder of the area.

Pipelines were used to transport effluent waste between facilities and to the Columbia River. Figure 2-13 shows pipelines exposed during facility demolition. Effluent transport products consisted of untreated river water, process water, cooling water, spent laboratory solutions, and decontamination solutions. Leakage from the pipeline system also contributed to unplanned releases. Figure 2-14 shows pipeline removal during source remedial action.

Figure 2-13. 100-F-44 Foundation and Pipelines in 1979

Figure 2-14. 100-F-26 (108-F Pipeline after Excavation in 2007; 105-F in Background)

Effluent from process sewer systems was discharged to outfall structures, which generally were open, reinforced, compartmentalized, concrete structures. Effluent was discharged from these structures to the Columbia River through either outfall pipelines at the bottom of the river or spillways leading to the shoreline.

A unique feature of the 100-F Area, shown in Figure 2-15, is the PNNL Outfall Structure (116-F-16 and 100-F-43 waste sites). This outfall structure and associated spillway were designed to channel animal sewage and process waste discharges from the EAF to the Columbia River. When river pipelines were blocked, damaged, or undergoing maintenance, process sewer waste and reactor cooling water were diverted to these spillways, which discharged to the Columbia River. Figures 2-15 through 2-18 show the configuration of the outfall structures over time.

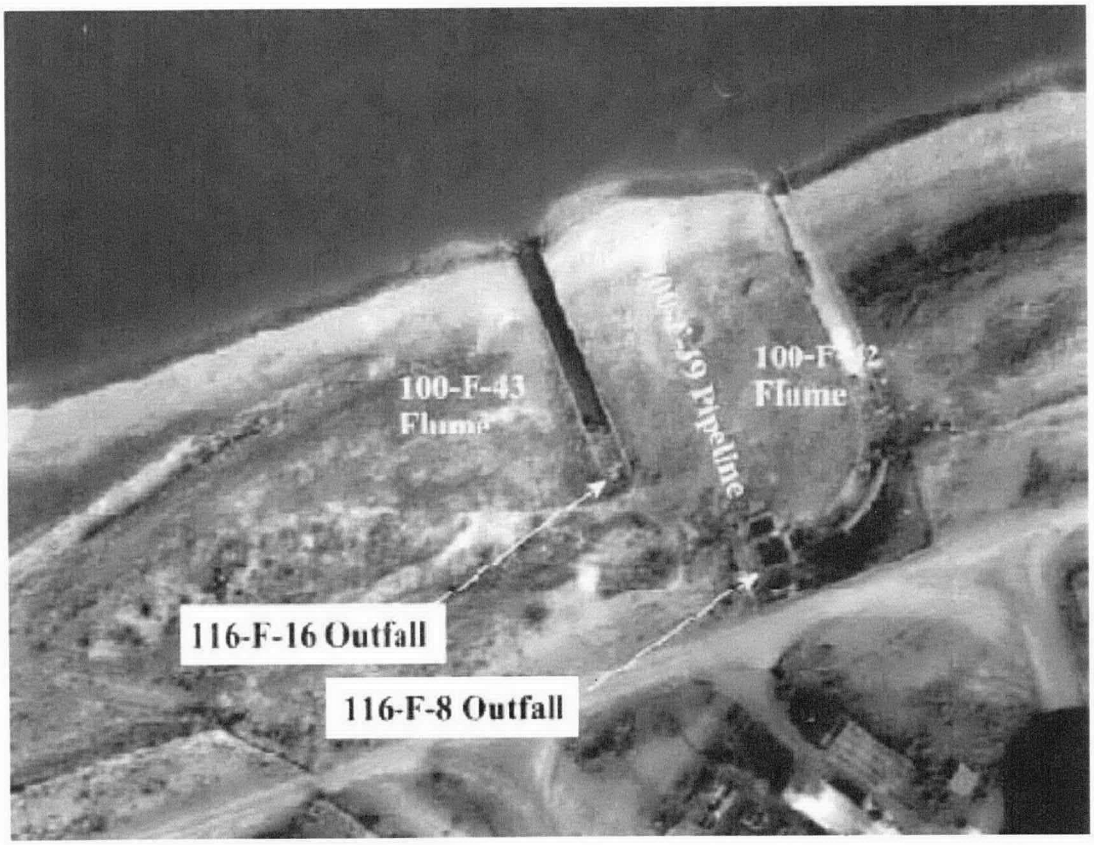


Figure 2-15. Aerial View of 100-F Outfall Structures (circa 1956)

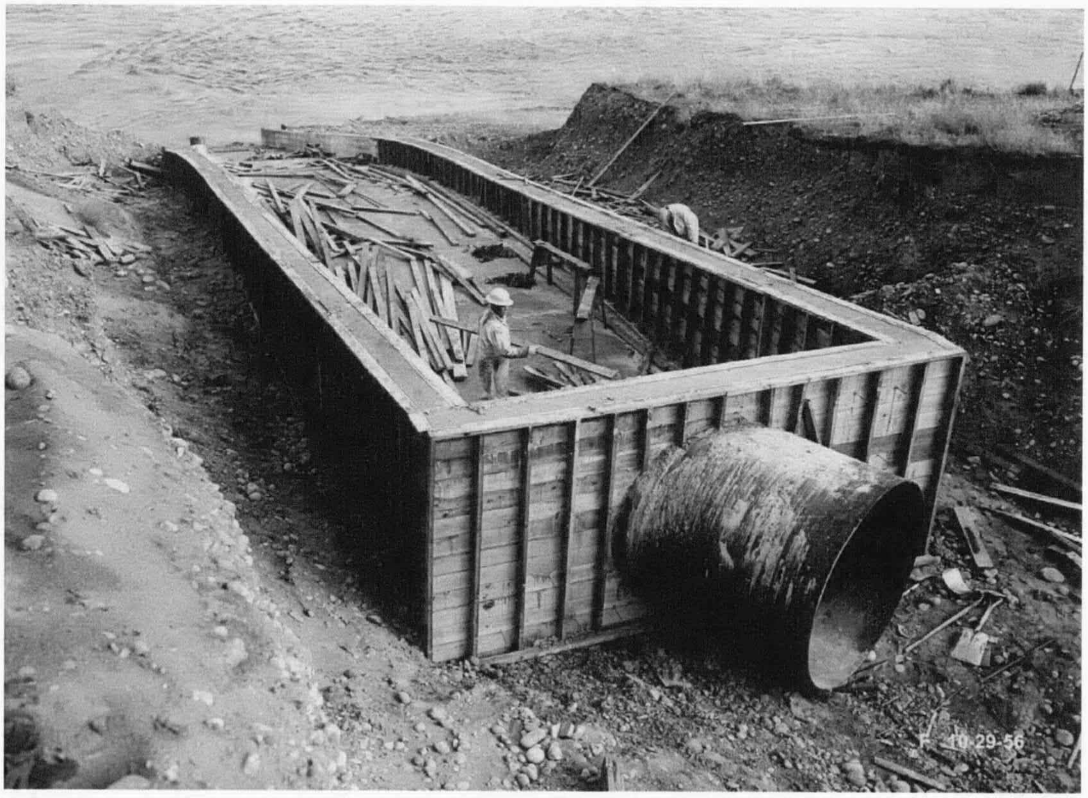


Figure 2-16. Construction of 116-F-16 Outfall in 1956

Figure 2-17. 116-F-16 Outfall Emplacement in 1956

Figure 2-18. Condition of Spillway 100-F-43 Before Remediation in 2005

2.2.4 Process History

Liquid wastes from reactor operations and associated facilities were released to the soil column and the Columbia River. Potential ongoing sources of contamination include remediated liquid waste sites, burial grounds, unplanned release sites, facilities/structures, and pipelines/outfalls. These site types are defined in the Integrated Work Plan (DOE/RL-2008-46). Appendix A shows the locations of 100-F waste sites. Appendices B and C present a complete listing of waste sites and facilities, including descriptions, histories, and classifications.

The primary activities causing environmental contamination in 100-F were the production and use of treated Columbia River water to cool the reactor during operations. Over the lifetime of the 105-F Reactor operations, approximately 2.3 trillion L (about 608 billion gal) of coolant were produced and passed through the reactor. As cooling water was produced and used, disposal and discharges of process chemicals introduced contaminants directly into the soil column underlying the production facilities and into the Columbia River. Groundwater contamination in the areas underlying the 100-IU-2 and 100-IU-6 OUs (tritium and iodine-129) is primarily from past disposal practices in the 200 East Area. The groundwater in these areas is addressed in the 200-PO-1 and 200-BP-5 OUs.

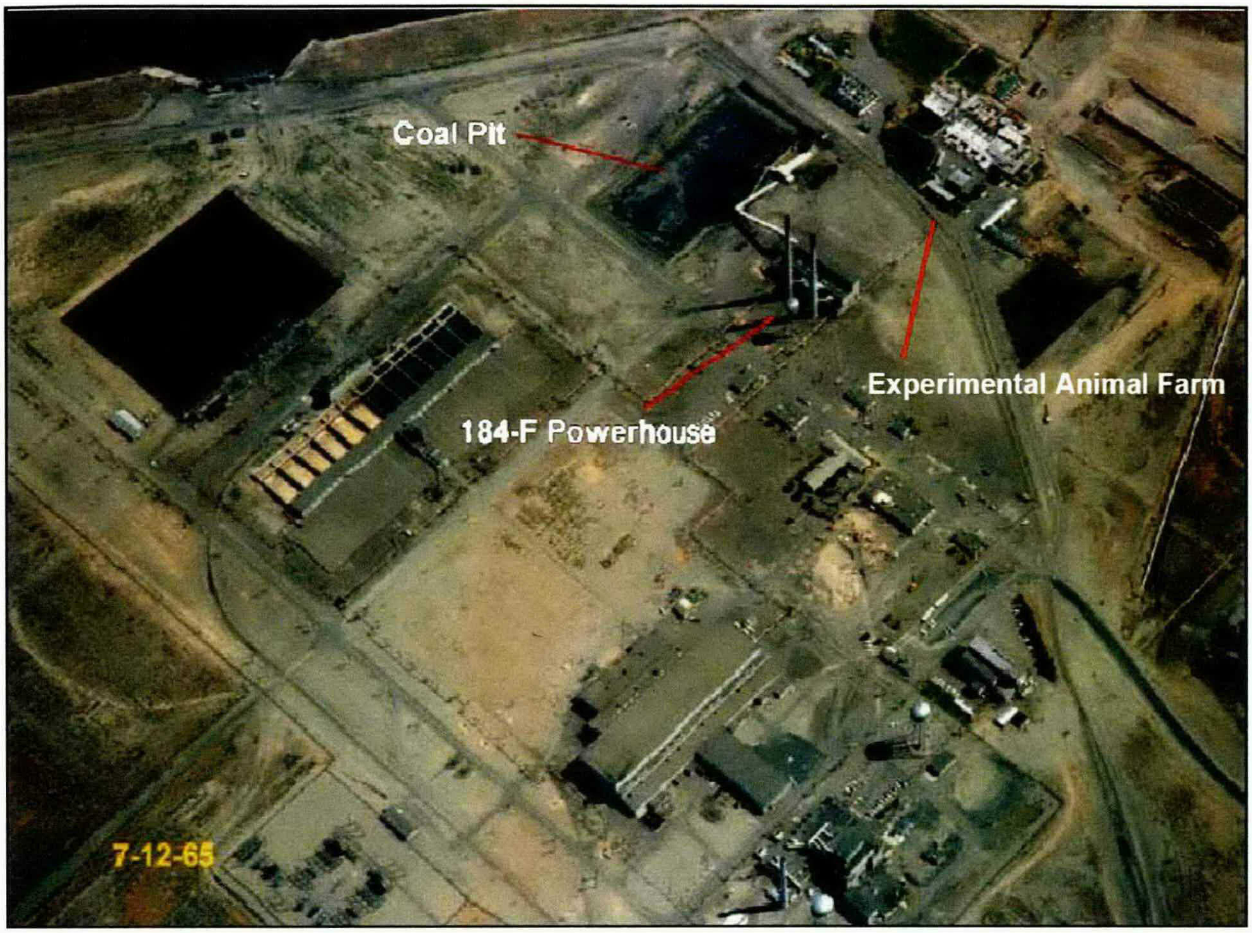
Producing plutonium for national defense was the primary mission of the Hanford Site reactors. Materials that had passed through the reactors for manufacture or materials contacting items that had passed through the reactors were considered radiologically contaminated. These materials represented the majority of the wastes produced. Active physical barriers and strong administrative measures were in place to minimize radiological hazards throughout the Hanford Site production areas to protect plant personnel. These measures affected the placement of disposal locations and waste management procedures for various waste streams.

Contaminant from the manufacturing process fall into the following categories:

- Process inputs:
  - Raw materials to be processed through the reactor, such as uranium fuel and cooling water
  - Process chemicals for water conditioning and inhibiting corrosion (e.g., sodium dichromate) because water management was crucial to the operation of the reactors and represents a major input subsystem
  - Materials used for reactor maintenance, such as acids, solvents, and heavy metals
- Process outputs:
  - Product and waste isotopes, such as Pu-239 and Sr-90, respectively
  - Radioactively and chemically contaminated materials (solid and liquid wastes)
  - Radioactively and chemically contaminated cooling water

Most of the irradiated fuel elements were shipped to the 200 Area for chemical processing, but some irradiated fuel elements were shipped to 100-BC for various metallurgical studies. Also during production, fuel element failures and infrastructure failures (e.g., pipe leaks) led to losses of contaminated materials to the environment.

Substantial infrastructure such as office buildings, laboratories, and subsurface piping was installed at 100-F to support reactor maintenance and operation (Figure 2-19). Wastes resulting from supporting production operations were similarly disposed in each area according to phase (liquids or solids), quantity (high/low mass or volume), radioactivity (high level or low level), and composition (strictly chemical or septic). Thus, liquid and solid waste disposal locations were constructed and waste management practices were developed to handle these materials consistently. Certain facilities and waste sites were used for discarding non-radiologically contaminated waste materials (e.g., solvents or chemicals), but were relatively small in scale.



Note: See top-right corner.

Figure 2-19. Aerial View of 100-F Area and Experimental Animal Farm

2.2.4.1 Reactor Processes

To produce reactor coolant for the 105-F Reactor, Columbia River water was pumped to the 183-F Facilities to remove impurities by conventional physical and chemical water treatment processes and then pumped to the 190-F Facility where sodium dichromate solution was added to the treated water to minimize process tube corrosion (Figure 2-20). Available documentation (DOE/RL-91-07, *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-2 Operable Unit, Hanford Site, Richland, Washington*) does not describe the method used to add the sodium dichromate, but the process solution mixed with the cooling water was derived from either solid sodium dichromate or highly concentrated stock solutions.

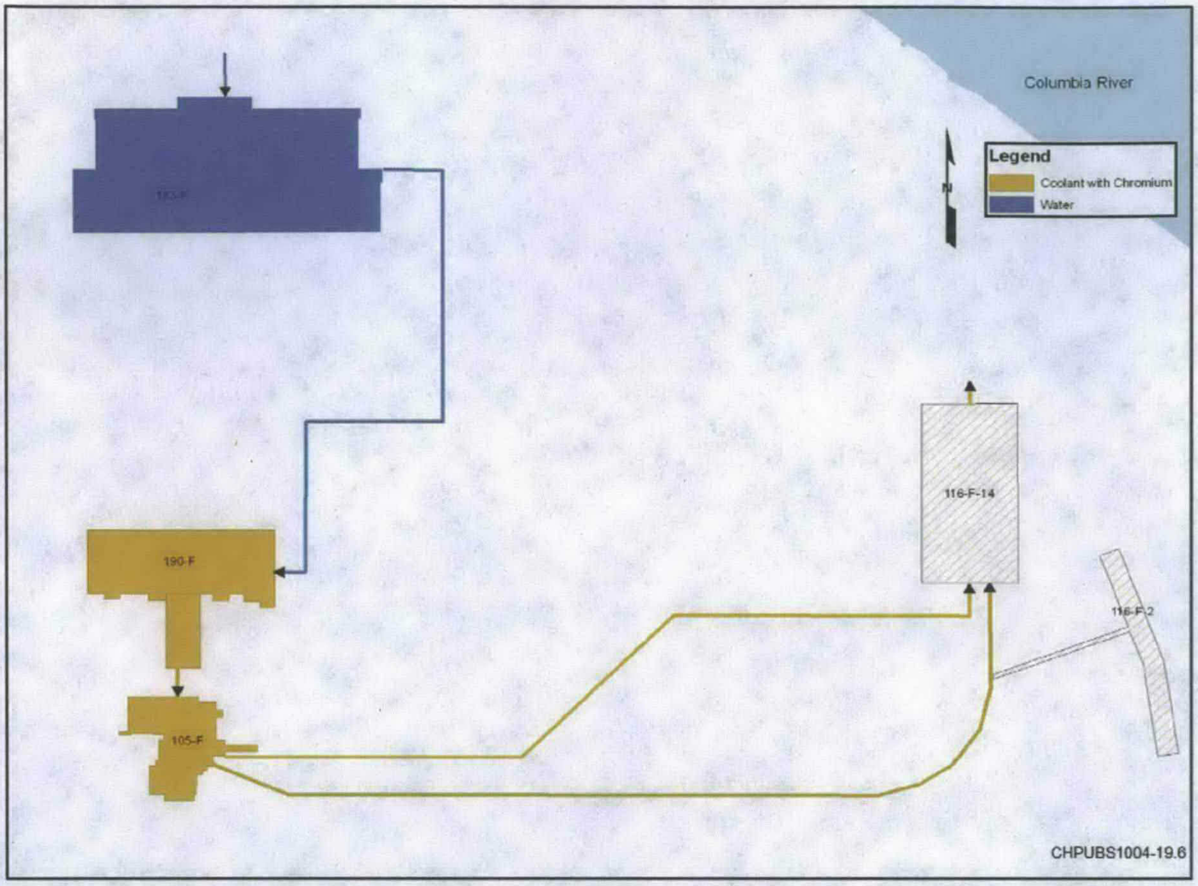


Figure 2-20. Production Facilities at 105-F for Reactor Coolant

Bulk sodium dichromate salt was used as the stock material for cooling-water treatment from about 1944 to approximately 1959 at the F Reactor when the transition to concentrated sodium dichromate solution was implemented (HW-61789, *Monthly Record Report, Irradiation Processing Department*). Sodium dichromate was added to the water in the 190-F Building. The crystalline sodium dichromate salt was batch dissolved in water to make a working solution of 10 to 15 percent sodium dichromate. This solution then was used to treat cooling water for the reactors.

High concentration (greater than 70 weight percent) sodium dichromate solutions were used as the stock material after 1959 until closure of the reactor. These materials were received by rail and truck tankers. The concentrated solution was subsequently diluted with water to make a 10 to 15 percent working solution. The moderate-concentration solution was then metered into the cooling-water stream downstream of the flocculation/sedimentation basin as the water was prepared for use in the reactor. These locations were the principal facilities where sodium dichromate was used or transferred.

Exactly when the routine use of concentrated liquid sodium dichromate solution to make process solutions was implemented is not entirely clear, but the change in process was probably introduced as part of the Project CG-558 upgrades at 105-F in early 1957 (DUN-6888, *Historical Events Single Pass Reactors and Fuel Fabrication*), and finished by 1959 (HW-61789). Once these solutions were generated, they were pumped through the 190-F Water Treatment facilities to the reactor and then to the outlet piping.

Initially, a sodium dichromate concentration of 700 to 800 micrograms per liter (μg/L) of Cr(VI) was used in coolant water. No reduction in dichromate concentration/usage is noted at 105-F, as was documented for 105-C, 105-KE, and 105-KW (DUN-4847, *Quarterly Report Contamination Control—Columbia River, April – June 1968*). Additionally, the volume of flow through the reactor was increased over time (DUN-6888). From these data, an approximate total coolant volume of 2.3 trillion L (608 billion gal) passed through the reactor containing about 1,600,000 kg (3,527,396 lb) of Cr(VI) (Table 2-3), assuming the lower end of the concentration range of 700 μg/L.

Table 2-3. Chromium Mass Discharge Estimates Based on Reactor Coolant Throughput

Year	Estimated Yearly Throughput (L/yr)[a] 105-F Coolant Volume Total	Chromium Inventory (kg)[b]	Calculated Dry Sodium Dichromate (kg/yr)
1945	9.08E+10	6.36E+04	1.66E+05
1946	9.08E+10	6.36E+04	1.66E+05
1947	9.08E+10	6.36E+04	1.66E+05
1948	9.08E+10	6.36E+04	1.66E+05
1949	9.08E+10	6.36E+04	1.66E+05
1950	9.08E+10	6.36E+04	1.66E+05
1951	9.08E+10	6.36E+04	1.66E+05
1952	9.08E+10	6.36E+04	1.66E+05
1953	9.08E+10	6.36E+04	1.66E+05
1954	9.08E+10	6.36E+04	1.66E+05
1955	9.08E+10	6.36E+04	1.66E+05
1956	9.08E+10	6.36E+04	1.66E+05
1957	1.4E+11	9.80E+04	2.56E+05
1958	1.4E+11	9.80E+04	2.56E+05
1959	1.4E+11	9.80E+04	2.56E+05
1960	1.4E+11	9.80E+04	2.56E+05
1961	1.4E+11	9.80E+04	2.56E+05
1962	1.4E+11	9.80E+04	2.56E+05
1963	1.4E+11	9.80E+04	2.56E+05
1964	1.4E+11	9.80E+04	2.56E+05
1965	7.0E+10	4.90E+04	1.28E+05
Total	**2.28E+12**	**1.60E+06**	**4.17E+06**

Note:

a. Estimated Yearly Throughput (RL-REA-2247, Historical Events, Reactors and Fuels Fabrication).

b. Estimate is based on a threshold concentration of 700μg/L at 105-F.

kg = kilogram

L = liter

yr = year

Contaminants in the discharged water included chemicals in the treated water and radioactive isotopes dissolved in the cooling water from breached fuel cladding. A major constituent in this water was sodium dichromate, added to minimize process tube corrosion. More than 4.19 million kg (4,190 metric tons) of sodium dichromate were used at 100-F between 1945 and 1965. The great majority of the sodium dichromate was used in the reactor coolant. Reactor cooling water was generated, passed through the reactors, and discharged at an average rate of about 230,000 L/min (62,000 gal/min) per reactor (DOE/RL-97-1047). Reactor coolant-grade water was also used to fill the fuel storage pool. Contaminants picked up and carried during passage of cooling water through the reactors include activation products in the water (e.g., Cr(VI)), activation products from targets or reactor components (e.g., tritium and cobalt-60), and products released through breached fuel cladding (e.g., Cs-137, Sr-90, uranium, and plutonium isotopes).

Radioactive coolant was discharged to the 116-F-2 overflow trench between 1950 and 1965. Contaminants estimated from *Hazard Ranking System Evaluation of CERCLA Inactive Waste Sites at Hanford* (PNL-6456) for 116-F-2 include tritium, Co-60, Sr-90, Cs-137, Pu-239, and europium (Eu)-152. The site also has a hazardous chemical inventory estimate that includes 60,000 kg (65 tons) of sodium dichromate.

Radioactive coolant discharge also occurred at a Pluto crib near the F Reactor. The 116-F-4 crib received waste briefly from 1950 to 1952. However, as a result of analogous site analysis (116-B-3, 116-D-2, and 116-DR-4), Cr(VI) has not been observed as a significant contaminant in most Pluto cribs (116-C-2 is the exception).

Finally, decontamination solutions using higher concentrations of dichromate were also used at 100-F, but management and disposition of these spent solutions was not always clear from process documentation. Several other avenues for disposal of these solutions were available, including disposal to the soil column and to the process sewer/outfall piping discharging to the river. Decontamination fluids used to clean radioactively contaminated equipment and containing Cr(VI) in the form of chromic acid were discharged near the reactor at the 116-F-10 Dummy Decontamination French Drain. The site received liquid waste containing 2,000 kg (2.2 tons) each of sodium dichromate, sodium oxylate, and sodium sulfamate. The site may have received other chemicals as well. Known decontamination solutions at 100-F included chromic acid, citric acid, oxalic acid, sulfamic acid, sulfuric acid, and sodium fluoride. Other chemicals, including organic solvents, were used for some decontamination processes.

Other sources of Cr(VI) were leaks or overflows in and around the outfall structure, and releases from smaller liquid discharge facilities (e.g., associated with decontamination), piping that carried reactor coolant, and some solid wastes (e.g., sludges).

3 Initial Evaluation

This chapter summarizes the initial evaluation of existing data and describes the current CSM for 100-F/IU-2/IU-6. The CSM expresses the current understanding of site conditions and makes possible the identification of data gaps and data needs in conjunction with the systematic planning process described in the Integrated Work Plan (DOE/RL-2008-46). The CSM is developed as a discussion of contaminant sources, contaminant nature and extent, contaminant fate and transport, and exposure pathways and receptors. Geology and hydrogeology of 100-F/IU-2/IU-6 are discussed Sections 2.1.2 and 2.1.3.

The CSM synthesizes area knowledge so project needs and decision-making requirements, including the design of remedial actions, can be developed. The CSM evolves through the RI/FS process, as the development and implementation of a remedy and the collection of data lead to an improved understanding of the key uncertainties. A well-developed CSM clarifies uncertainties and describes the specifications required for a satisfactory solution. Resolving the uncertainties through the CSM process provides the data and information necessary to develop and implement the remedy.

Groundwater contaminants found within 100-F/IU-2/IU-6 are primarily from Hanford operations in the 200 East Area. These contaminants are being investigated and remediated through work related to the 200-BP-5 and 200-PO-1 groundwater OUs. Therefore, no additional work is proposed within this RI relating to these plumes, contaminant sources, and release mechanisms.

3.1 Contamination Sources

Liquid and solid wastes from reactor operations and associated facilities, as well as from the EAF, were released to the soil column and the Columbia River. Sources of contamination include spills, leaks, and past liquid and solid waste disposal sites. Process knowledge and historical research (including the orphan site identification process) have identified primary and secondary sources across most of the area.

3.1.1 Primary Sources of Contamination

The primary sources of contamination in the 100-F area of 100-F/IU-2/IU-6 are the water-cooled nuclear reactor (105-F) and the structures (e.g., fuel storage basins [FSB]) and processes (e.g., sodium dichromate process) associated with reactor operations. The reactor was built to irradiate uranium-enriched fuel rods from which plutonium and other special nuclear materials could be extracted (in the 200 Area). The processes associated with reactor operations generated large quantities of liquid and solid wastes.

Effluent generated during operations consisted primarily of contaminated reactor cooling water, FSB water, and decontamination solutions. Cooling water consisted of river water treated to remove dissolved solids and enhanced with chemicals to reduce corrosion. Cooling water contaminants consisted of fuel materials, fission and irradiation by-products, and Cr(VI) (added to inhibit corrosion). Solid wastes consisted of sludge, reactor components, and various other contaminated items. Waste generated from reactor operations was contaminated with radionuclides, hazardous chemicals, or both. Deliberate and unintended releases of waste resulting from operations were the primary contaminant release mechanisms.

Liquid contaminants were released directly to the environment by discharging effluent to temporary surface impoundments, cribs, ditches, and the Columbia River. Solid waste was placed in unlined burial grounds. Numerous facilities and systems were established (e.g., EAF) or repurposed (e.g., 108-F) for biological experimentation activities at 100-F that continued after the plutonium production mission ended. These activities also generated large quantities of contaminated animal and plant wastes (both solid and liquid) that were managed onsite.

Facilities and waste sites in the 100-IU-2/IU-6 OUs consist mostly of landfills, burn pits, storage facilities, guard towers/control structures, contaminated receiving vaults, and pre-Hanford farm sites. These OUs also include the White Bluffs and Hanford townsites, and pre-Hanford landfills. By design, facilities were mostly temporary in nature and were removed after they were no longer needed.

3.1.2 Secondary Sources of Contamination

Wastes released to the environment created secondary sources of contamination where contaminants were retained in the subsurface and released over long periods, such as ditches, cribs, burial grounds, and unplanned release sites. Contaminant sources (i.e., waste sites and facilities) are listed in Appendices B and C. Secondary sources also can impact the environment through the following secondary release mechanisms:

- Re-suspension of contaminated soil via wind or excavation activities
- Direct contact with contaminated soil
- Biotic uptake of contaminants via direct contact with soil or ingestion of soil, vegetation, or other animals
- Migration of contaminated liquids through the soil column via infiltration or percolation
- External radiation

3.2 Previous Vadose Zone Investigations

This section describes previous investigations and remedial activities at 100-F/IU-2/IU-6. No limited field investigations (LFIs) for the 100-IU-2 and 100-IU-6 Source OUs have been performed to date.

Significant information regarding source area contamination was gathered as part of 100-F investigations and documented in various forms (e.g., remaining site verification packages [RSVPs], cleanup verification packages [CVPs], or site summary reports).

The description of vadose zone contamination in this section is based mainly on the Radiological Characteristics of the 100 Areas (UNI-946; DOE/RL-93-82, *Limited Field Investigation Report for the 100-FR-1 Operable Unit*: and interim remedial actions completed in the area.

3.2.1 Initial Vadose Zone Radiological Characterization – 1975

Radiological characterization of the 100 Area was initially performed in 1975 (UNI-946). The purpose of characterization was to establish an estimate of radionuclide inventories, distribution, and concentrations at inactive solid and liquid wastes sites, reactors, and associated facilities.

The focus of the sampling activities was 100-F liquid waste receiving sites and retention basins. Shallow boreholes were drilled in and adjacent to waste site boundaries to a maximum depth of 9 m (30 ft). Sampling was performed at 15 waste sites in 100-F. Based on process knowledge, samples were analyzed for the following constituents: carbon-14, cobalt-60, cesium-134, cesium-137, europium-152, europium-154, europium-155, nickel-63, plutonium-238, plutonium-239/240, Sr-90, tritium, and uranium. Table 3-1 summarizes the characterization efforts and results.

Table 3-1. Summary of 100-F Waste Site Characterization in 1975

Waste Site	Number of Boreholes	Media	Depth of Investigation (m [ft] bgs)	Major Radionuclides	Relevant Information
116-F-1 Lewis Canal	14	Soil	5 (15)	Cs-134 Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90 Tritium Pu-239/240 Uranium	Maximum level of contamination was found at a depth of 0.9 m (3 ft) bgs. Total radioactive inventory was estimated at 3.4 Ci.
116-F-2 Basin Overflow Trench	4	Soil	9 (30)	Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90 Tritium Pu-239/240 Uranium	Maximum level of contamination was found in the 6 to 7.6 m (20 to 25 ft) bgs interval. The majority of the contamination in this trench was in its northern half. Total radioactive inventory was estimated at 15 Ci.
116-F-3 Fuel Storage Basin Trench	2	Soil	6 (20)	Co-60 Eu-152 Eu-155 Sr-90 Tritium	Total radioactive inventory was estimated at 0.0021 Ci.
116-F-4 Pluto Crib	2	Soil	6 (20)	Cs-134 Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90 Tritium Pu-238 Pu-239/240 Uranium	Pu-239/240 was detected at concentrations up to 110 pCi/g. Total radioactive inventory was estimated at 3.5 Ci.
116-F-5 Ball Washer Crib	1	Soil	3 (10)	Cs-137 Eu-154 Eu-155 Sr-90	All detected contaminants were less than 1 pCi/g.
116-F-6 Liquid Waste Disposal Trench (1608-F)	4	Soil	8.5 (28)	Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90 Tritium Pu-238 Pu-239/240 Uranium	Maximum level of contamination was found at a depth of 2.3 m (7.5 ft) bgs. Total radioactive inventory was estimated at 6.5 Ci.

Table 3-1. Summary of 100-F Waste Site Characterization in 1975

Waste Site	Number of Boreholes	Media	Depth of Investigation (m [ft] bgs)	Major Radionuclides	Relevant Information
116-F-7 Crib (117-F)	1	Soil	3 (10)	Cs-137 Eu-152 Pu-239/240 Sr-90	Total radioactive inventory was estimated at 0.00014 Ci.
116-F-9 Animal Waste Leach Trench	6	Soil	9 (30)	Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90 Pu-239/240	Maximum level of contamination was found at a depth of 6.86 m (22.5 ft) bgs. No contamination was detected above 4.5 m (15 ft) bgs. Total radioactive inventory was estimated at 4 Ci.
116-F-10 Dummy Decontamination French Drain	3	Soil	8.2 (27)	Cs-134 Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90 Tritium Pu-239/240 Uranium	Maximum level of contamination was found at a depth of 3.8 m (12.5 ft) bgs.
116-F-14 Retention Basin (107-F Retention Basin)	3 (inside) 14 (perimeter)	Soil Sludge Concrete	9 (30)	Cs-134 Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Ni-63 Sr-90 Tritium Pu-238 Pu-239/240 Uranium	The majority of the contamination under the basin is confined to within 1.5 m (5 ft) of the basin floor; 40 percent of the total radionuclide inventory is beneath or outside the basin due to leakage. Contamination extends 7.6 to 15 m (25 to 50 ft) from the basin. Total radioactive inventory was estimated at 93 Ci.
118-F-5 Sawdust Pit	5	Soil Sawdust	NA	Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90 Pu-239/240	Radioactive contamination was detected in fine sand and sawdust at about 1.8 to 2 m (6 to 7 ft) below fill grade. Total radioactive inventory was estimated to be 2 to 4 Ci.

Table 3-1. Summary of 100-F Waste Site Characterization in 1975

Waste Site	Number of Boreholes	Media	Depth of Investigation (m [ft] bgs)	Major Radionuclides	Relevant Information
132-F-6 Lift Station Demolition Site	1	Soil	9 (30)	Cs-134 Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90 Pu-239/240	Maximum level of contamination was found at 1.5 m (5 ft) bgs.
EM Bypass Ditch to 116-F-2	5	Soil	6 (20)	Cs-134 Cs-137 Co-60 Eo-152 Eu-154 Eu-155 Sr-90 Tritium Pu-239/240 Uranium	Total radioactive inventory was estimated at 2.6 Ci.
UPR-100-F-2, Basin Leak Ditch	4	Soil	4.6 (15)	Cs-134 Cs-137 Co-60 Eu-152 Eu-154 Eu-155 Sr-90 Tritium Pu-239/240 Uranium	Total radioactive inventory was estimated at 1.4 Ci.
Effluent Pipeline (Process/Discharge Pipeline)	4	Soil	6 (20)	Cs-137 Co-60 Eu-152 Eu-155 Sr-90 Tritium Uranium	Cs-137, Co-60, Sr-90, and Eu-155 were detected in samples of scale collected from inside one of the 1 m (3 ft) diameter pipelines.

Notes:

Documented in UNI-946, *Radiological Characterization of the Retired 100 Areas.*

bgs = below ground surface

NA = Not Available

3.2.2 100-F Source Operable Unit Limited Field Investigations

An LFI was performed in the 100-FR-1 OU in 1993. Results of the investigation are presented in the LFI Report for the 100-FR-1-OU (DOE/RL-93-82). Data collection and analysis activities were conducted in accordance with DOE/RL-90-33, *Remedial Investigation/Feasibility Study Work Plan for the 100-FR-1 Operable Unit, Hanford Site, Richland, Washington*.

In the 100-FR-1 OU, 18 sites were identified as high-priority waste sites and five sites were identified as low-priority waste sites. Based on the work plan, eight of the 18 high-priority waste sites were investigated during the LFI:

- 116-F-1 Lewis Canal
- 116-F-2 Basin Overflow Trench
- 116-F-3 Storage Basin Trench
- 116-F-4 Crib
- 116-F-6 Liquid Waste Disposal Trench
- 116-F-9 PNL Animal Waste Leach Trench
- 116-F-14 Retention Basin
- 108-F French Drain

One of the low-priority waste sites, 132-F-1 Chronic Feeding Barn, was also investigated because it was associated with the EAF and is unique to the 100-FR-1 OU. These sites were investigated using the following methods:

- Cable-tool drilling of boreholes
- Backhoe excavation of test pits
- Sampling for geological and physical properties
- Sampling for radiological and chemical constituents
- Borehole geophysical logging
- Sampling of surface sediments and field screening for volatile organic compounds (VOCs), metals, and man-made radionuclides

Table 3-2 summarizes the investigative activities for each waste site. The LFI results (DOE/RL-93-82) indicated that the radiological contamination in the vadose zone soil is the primary concern.

- The principal radionuclides found during the LFI include cesium-137, cobalt-60, europium-152, europium-154, plutonium-238, potassium-40, radium-226, strontium-90, and thorium-228. The highest concentrations of radionuclides were found in 116-F-4 Pluto Crib and the 116-F-14 Retention Basin.
- Semi-volatile organic compounds (SVOCs) were detected at low concentrations and were generally below the contract required quantitation limits.
- VOCs, while detected, were generally at low concentrations and/or likely laboratory contaminants.
- None of the investigated analytes exceeded potential soil applicable or relevant and appropriate requirements such as *Model Toxics Control Act (MTCA)* (WAC 173-340-705, "Model Toxics Control Act -- Cleanup") Method B cleanup criteria.

- Contaminant concentrations and locations generally confirm historical information documented in *Radiological Characterization of the Retired 100 Areas* (UNI-946).

Table 3-2. Summary of Limited Field Investigation for 100-F

Waste Site	Radiological	Metal (exceeded HSB)	Organic (exceeded CRQL)	Relevant Information
116-F-1 Lewis Canal				
Waste Site Depth: 3 m (10 ft) No. of boreholes: 1 Borehole depth: 6.7 m (22 ft) No. of test pits: 2 Test pit depths: 5.5 and 6 m (18 and 20 ft)	C-14 Cs-137 Eu-152 Pu-239/240 K-40 Ra-226 Sr-90 Th-228 Th-232 U-233/234 U-238	Arsenic Lead Zinc	Acetone Methylene chloride Toluene Bis(2-ethylhexyl) phthalate	VOC detections are most likely attributable to sampling media or laboratory contamination. No historical records indicate that acetone, methylene chloride, or toluene were disposed of in the 100-FR-1 OU. Bis(2-ethylhexyl) phthalate was the only SVOC detected in the canal at 0 to 0.3 m (0 to 1 ft) bgs. Geophysical logging showed maximum concentrations of man-made radionuclides at 0.3 to 2 m (1 to 6.5 ft) bgs. No pesticides or PCBs were detected.
116-F-2 Basin Overflow Trench				
Waste Site Depth: 4.6 m (15 ft) No. of boreholes: 1 Borehole depth: 10.9 m (35.7 ft)	C-14 K-40 Cs-137 Co-60 Eu-152 Eu-154 Pu-239/240 Sr-90*	Barium Cadmium Total chromium Zinc	None	No pesticides or PCBs were detected. Radionuclide contamination was detected from ground surface to total depth of the trench. The highest concentrations of radionuclides were in the 3 to 3.6 m (10 to 12 ft) bgs interval in fill material.

Table 3-2. Summary of Limited Field Investigation for 100-F

Waste Site	Radiological	Metal (exceeded HSB)	Organic (exceeded CRQL)	Relevant Information
116-F-3 Fuel Storage Basin Trench				
Waste Site Depth: 2.4 m (8 ft) No. of test pits: 1 Test pit depth: 5.2 m (17 ft)	Am-241 Cs-137 Co-60 Eu-152 Eu-154 Pu 238 Pu-239/240 K-40 Ra-226 Th-228 Th-232 U-233/234 U-238	Barium Total chromium Lead Mercury Zinc	Toluene 4-Methyl 2-pentanone Fluoranthene Pyrene Toxaphene Aroclor-1254	Background was exceeded from 2.1 to 3.6 m (7 to 12 ft) bgs, with maximum concentrations at 2.1 m (7 ft) bgs. Historical records do not indicate the disposal of VOCs or SVOCs.
116-F-4 Pluto Crib				
Waste Site Depth: 3 m (10 ft) No. of boreholes: 1 Borehole depth: 8.5 m (28 ft)	Am-241 Cs-137 Co-60 Eu-152 Eu-154 Pu 238 Pu-239/240 K-40 Ra-226 Sr-90 Th-228 Th-232 U-233/234 U-235	Barium	2-butanone Acetone Toluene Bis(2-ethylhexyl) phthalate	No pesticides or PCBs were detected. Radionuclide contamination was detected from ground surface to total depth of the borehole, with maximum concentrations at 2.9 to 3.5 m (9.4 to 11.4 ft) bgs.
116-F-6 Liquid Waste Disposal Trench				
Waste Site Depth: 3 m (10 ft) No. of boreholes: 1 Borehole depth: 8 m (26 ft)	Co-60* Ca-137 Eu-152 Eu-154 Pu-239/240 K-40 Sr-90*	Total Chromium Zinc	Acetone Toluene	No SVOC compounds were detected above the CRQL. No pesticides or PCBs were detected. Maximum radionuclide contamination was detected at 2 to 2.6 m (6.5 to 8.5 ft) bgs, which was reported to be fill material.

Table 3-2. Summary of Limited Field Investigation for 100-F

Waste Site	Radiological	Metal (exceeded HSB)	Organic (exceeded CRQL)	Relevant Information
116-F-9 Animal Waste Leach Trench				
Waste Site Depth: 3 m (10 ft) No. of boreholes: 1 Borehole depth: 8 m (26.8 ft) No. of test pits: 1 Test pit depth: 6 m (20 ft)	C-14* Cs-137 Co-60 Eu-152 Pu-239/240 K-40* R-226 Sr-90* Th-228* Th-232 U-233/234 U-238	Copper Silver Zinc	2-butanone 4-Methyl 2 pentanone Acetone Toluene Bis(2-ethylhexyl) phthalate Alpha-chlordane Gamma-chlordane	Maximum radiological contamination in both the borehole and test pit was detected in the 2.7 to 3 m (9 to 10 ft) bgs interval.
116-F-14 Retention Basin				
Waste Site Depth: 7.3 m (24 ft) No. of boreholes: 1 Borehole depth: 8.1 m (26.6 ft)	C-14* Co-60* Sr-90* Cs-137* Eu-152* Eu-154* Eu-155* Pu-239/240* K-40*	Cadmium Copper Total chromium Zinc	Acetone Toluene Di-ethylphthalate Di-n-butylphthalate	No pesticides or PCBs were detected.
108-F French Drain				
Surface samplings: 2 Sampling depths: 0.3 to 0.46 m and 1 to 1.4 m (1 to 1.5 ft and 3.5 to 4.5 ft)	Am-241* Cs-137* Pu-238* Pu 239/240* K-40*	Total chromium Copper Lead Zinc	Toluene Bis(2-ethylhexyl) phthalate Aroclor-1254 Aroclor-1260	Historical records reviewed do not indicate the use of toluene or bis(2-ethylhexyl) phthalate at the 108-F Laboratory.
132-F-1 Chronic Feed Barn				
No. of test pits: 1 Test pit depth: 1.8 m (6 ft)	K-40* Ra-226 Th-228 Th-232	None	Acetone Bis(2-ethylhexyl) phthalate Gamma-chlordane	Primary radionuclides used in the animal studies were I-131, Cs-137, Pu-239, and Sr-90.

Notes:

* greater than 1 pCi/g

bgs = below ground surface

CRQL = contract-required quantification limit

HSB = Hanford Site background

PCB = polychlorinated biphenyl

SVOC = semi-volatile organic compound

VOC = volatile organic compound

The vertical distributions of contamination beneath the 116-F-4 Crib and 116-F-14 Retention Basin are shown in Figures 3-1 and 3-2, respectively, along with relationships to stratigraphy and the engineered structure. The depth of remedial action is inserted into the profiles as an indicator of soil removed during interim remedial action approximately 8 years after the completion of the LFI. The depth of remedial action (soil removal) at 116-F-4 and 116-F-14 is 5.5 m (18 ft) and 4.6 m (15 ft), respectively.

The profile of the 116-F-4 Crib shows that contaminant concentrations generally decrease with depth, with the exception of total chromium. Higher concentrations are generally present about 3 m (10 ft) below ground surface (bgs) and are associated with the bottom of the engineered structure. Total chromium concentrations increase with depth to the bottom of the borehole.

The profile of the 116-F-14 Retention Basin also shows that contaminant concentrations generally decrease with depth. Higher concentrations are generally present about 1.5 to 2 m (5 to 6.5 ft) bgs. Total chromium concentrations generally decrease with depth.

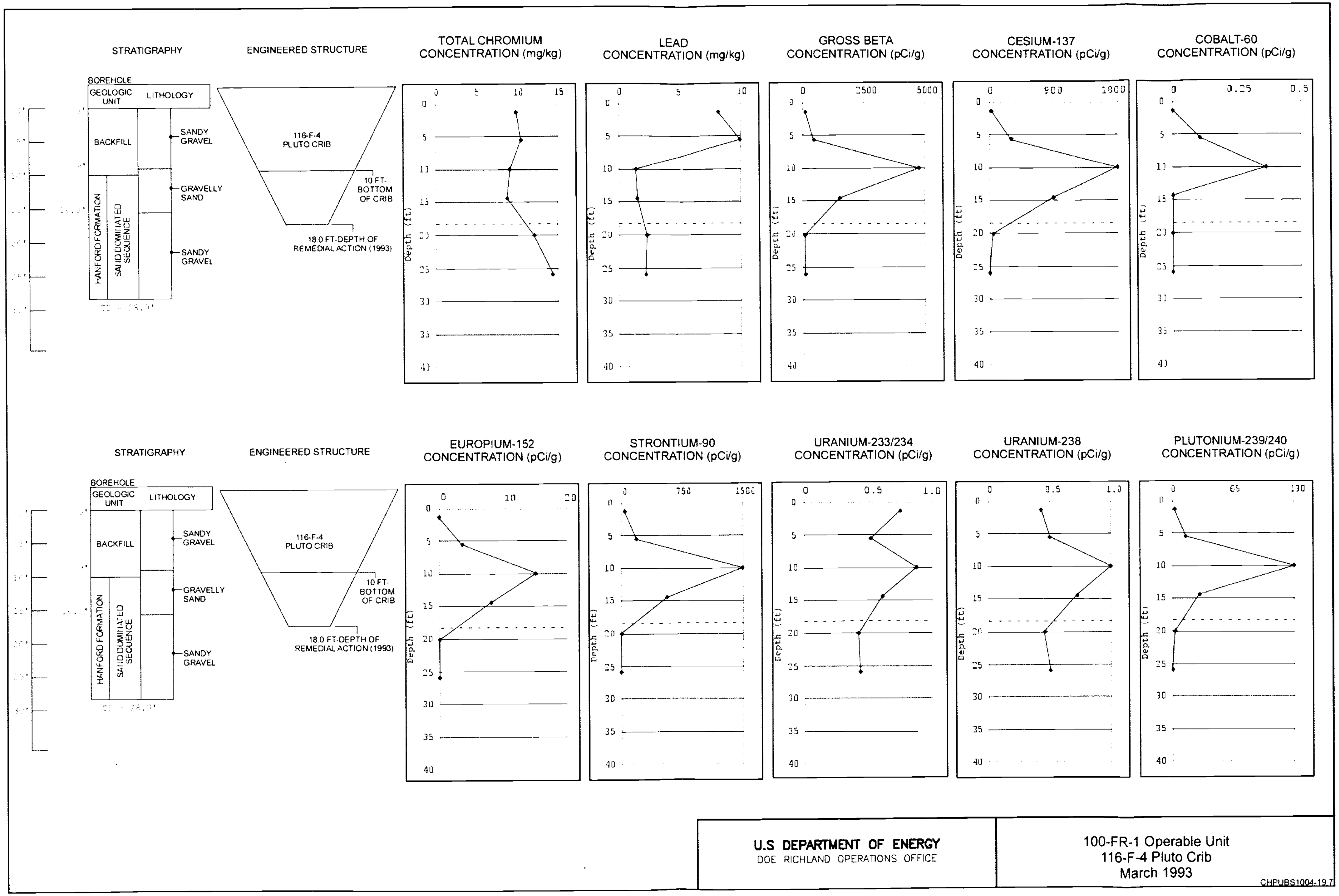


Figure 3-1. Vertical Profile of 116-F-4 Pluto Crib Contamination

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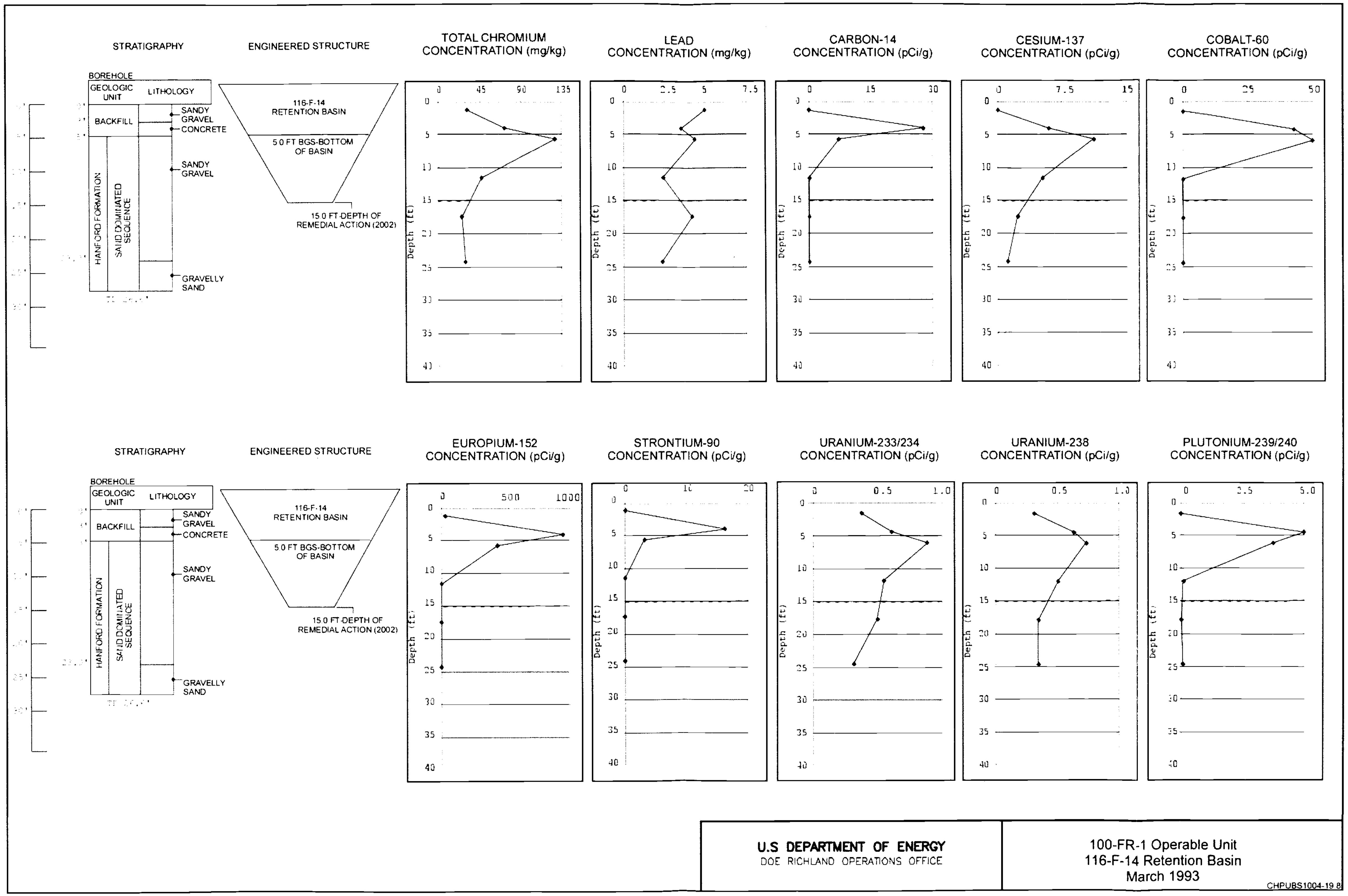

Figure 3-2. Vertical Profile of 116-F-14 Retention Basin Contamination

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3.2.3 100-F Soil Leachability Study

Leach tests are conducted to evaluate the partitioning of constituents between aqueous and solid phases. The data from testing may be used to define the leaching potential of contaminants in the subsurface, estimate contaminant distribution coefficients for use in fate and transport modeling, and develop remedial action goals.

Cleanup verification activities to document completion of remedial actions for waste sites associated with the 100-F-19 Reactor cooling water effluent pipelines were completed in 2001. A soil leachability study was conducted as part of these activities to assess the leaching potential of Cr(VI) and C-14 in soil at 100-F. Soil with elevated levels of Cr(VI) and C-14, collected from the 116-F-14 Retention Basin, was selected for the leachability study. The leach tests consisted of a soil and water mixing procedure of 30 rotations per minute for 18 hours. The leach testing methodology and results are documented in CVP-2001-00002, *Cleanup Verification Package for the 100-F-19:1 and 100-F-19:3 Reactor Cooling Water Effluent Pipelines, 100-F-34 Biology Facility French Drain, and 116-F-12 148-F French Drain*, Appendix D, *100-F Area Soil Cr(VI) and Carbon-14 Leachability Study Summary Report*. A summary of the leachability study findings follows.

Hexavalent Chromium. Initial leachability testing showed that Cr(VI) remaining in the soil column is not readily mobilized, based on the low concentrations of hexavalent and total chromium detected in the leachate.

The Cr(VI) ambient surface water quality criterion is 10 μg/L (33 USC 1251 et seq., *Clean Water Act of 1972*; 40 CFR 131, "Water Quality Standards"). Applying the near-shore dilution attenuation factor of 1:1 (EPA/AMD/R10-00/122, *Interim Remedial Action Record of Decision Amendment for the 100-HR-3 Operable Unit, Hanford Site, Benton County, Washington, Hanford Site, Benton County, Washington*) to the surface water quality criterion yields a remedial action goal of 20 μg/L, with the river protection compliance point as near-shore groundwater (i.e., Cr(VI) groundwater concentrations of 20 μg/L or less are protective of the river).

Using the simple approach of comparing the Cr(VI) leachate concentrations directly to the river protection remedial action goal, 100-F leach testing data indicate that a 7.2 mg/kg Cr(VI) soil concentration is protective of the river. The test threshold Cr(VI) soil concentration appears to be in the 7.4 mg/kg to 7.6 mg/kg range, where the resulting leachate Cr(VI) concentration begins to exceed 20 μg/L. The results from the 100-F aggressive single batch leach tests are consistent with the aggressive leach tests conducted for 100-D soil (CVP-99-00007, *Cleanup Verification Package for 116-D-7 Retention Basin*) and 100-H soil (CVP-2000-00027, *Cleanup Verification Package for 116-H-7 Retention Basin*). However, a soil distribution (partition) coefficient (K_d) value for Cr(VI) was not calculated as part of this study.

Carbon-14. During leachability testing, soil with concentrations of C-14 up to 48.7 pCi/g did not leach detectable concentrations of C-14. The aggressive leachability testing of 100-F soil demonstrates that C-14 in the soil is not mobilized or leached by water with the typical composition of 100 Area groundwater, and it has been concluded that additional C-14 testing using column leach tests is not necessary.

Results of recent column leach studies are presented in PNNL-17674, *Geochemical Characterization of Chromate Contamination in the 100 Area Vadose Zone at the Hanford Site*. Results show multiple categories of Cr(VI) with different leaching behavior. The dominant category is highly mobile with a K_d at or near zero.

3.2.4 100-F/IU-2/IU-6 Orphan Site Evaluation

A comprehensive orphan site evaluation (OSE) field investigation was conducted for 100-F and is in process for the 100-IU-2 and 100-IU-6 OUs (with an anticipated completion date of 2013) to identify additional sites that may require characterization and possible remediation. The OSE historical review was composed of detailed reviews of hundreds of documents, drawings, and photographs, as well as interviews with several former employees. The field investigations include walkovers, geophysical investigations (electromagnetic induction, magnetic gradient, time domain electromagnetic, and ground-penetrating radar), and physical hazards identification.

The OSE process for 100-F was completed in 2005 (OSR-2005-0001, *100-F Area Orphan Sites Evaluation Report*). The total area covered for 100-F was approximately 322 ha (795 ac) and 15 new waste sites were identified. These waste sites, which include pipelines, French drains, septic systems, contaminated soils, and debris, will be evaluated and dispositioned. An initial OSE of the 100-IU-2 and 100-IU-6 OUs was conducted between October 2006 and October 2007. The area covering the 100-IU-2 and 100-IU-6 OUs is included the White Bluffs community and the Hanford townsite, which collectively cover a total area of approximately 3,561 ha (8,800 ac). Forty-three orphan sites were identified during this evaluation process.

An extensive and detailed review of aerial photographs for the remaining areas of 100-IU-2/IU-6 is currently ongoing. During this review, disturbed areas as indicated in the photographs will be noted and further investigated. This process may identify additional waste sites.

DOE has implemented a number of processes to identify new waste sites (Integrated Work Plan). The process of identifying new waste sites increases confidence that waste disposal and releases requiring characterization and cleanup within a given land parcel on the Hanford Site are addressed. In 1996, 170 waste sites were identified in WIDS for 100-F/IU-2/IU-6. Between 1996 and 2009, an additional 89 waste sites were identified. This brings the number of waste sites up to 259 inclusive of 58 new sites identified during the orphan site process.

3.3 Interim Remedial Action and Existing Waste Site Contamination

The production and processing of nuclear material has contaminated the facilities, soil column, and groundwater underlying 100-F/IU-2/IU-6. The removal of contamination sources has been the focus of remedial activity in this area (100-FR-1, 100-FR-2, 100-IU-2, and 100-IU-6 OUs). The various cleanup actions for the identified source areas consist of demolishing buildings, excavating contaminated soil for treatment and disposal, and where dictated, performing *Resource Conservation and Recovery Act of 1976* (RCRA) compliance actions.

Remediation and characterization of the waste sites in 100-F/IU-2/IU-6 began in 1999 under the authority provided by the interim action ROD (EPA/ROD/R10-99/039) and continues to the present. Remediation consists mainly of removal, segregation, storage, transportation, and disposal of soil, debris, and waste material and backfilling of remediated waste sites. In a few cases, such as for "no action" waste sites, remediation was not warranted based on assessment of quantitative waste site data indicates that contaminant concentrations are less than remedial action goals.

In most cases, removal/treatment/disposal (RTD) is the remedy selected for source waste sites in the 100 Area. Remedial actions are designed to achieve remedial action objectives (RAOs) and goals specified in interim action RODs for direct exposure applicable to soil 0 to 4.6 m (0 to 15 ft) bgs and protection of groundwater and the Columbia River. In practice, this has involved excavating wastes and soil that exceed cleanup criteria followed by disposal in the Environmental Restoration Disposal Facility (ERDF). Residual contamination remaining after excavation is sampled and modeled to assess potential impacts to groundwater and the Columbia River. Where RAOs and remedial action goals are achieved, the waste site is classified as "interim closed."

To date, high-priority 100-F/IU-2/IU-6 liquid waste sites have been remediated in accordance with RAOs and backfilled with uncontaminated soil. Excavation efforts have included pipeline removal (Figure 3-3) followed by an evaluation of the lowest-priority waste sites. Solid waste burial ground and remaining site cleanup activities have been conducted for septic systems, burn pits, and buildings that were demolished in place, but remediation of 100-F/IU-2/IU-6 source areas is not complete.

Characterization of waste sites consists mainly of sample collection (i.e., confirmation and verification sampling) and analysis for the purposes of assessing the nature and extent of contamination and verifying achievement of RAOs and remedial action goals. Achievement of RAOs is based on attaining remedial action goals for direct exposure, protection of groundwater, and protection of surface waters. Interim action RAOs and remedial action goals, as described in the work pla,n were achieved at all interim closed and no action waste sites. Contaminant inventories and impacts to the environment are significantly reduced, and progress toward meeting RAOs and remedial action goals has been achieved. The process of removing contaminated material from waste sites has the net effect of changing the nature and extent of waste site contamination. Therefore, information from previous investigations presented in the *Radiological Characterization of the Retired 100 Areas* (UNI-946) and the LFI reports for the Source OUs no longer reflects post-interim remediation conditions, at least to the depth of remedial action. For example, in Figures 3-1 and 3-2, relationships are shown between the stratigraphy, the engineered structure, the depth of remedial action, and contamination at waste sites. These figures show that all material to the depth of remedial action has been removed.

Two interim action RODs have been prepared to address source contamination in 100-F/IU-2/IU-6 (EPA/ROD/R10-99/039; EPA/ROD/R10-00/121, *Interim Remedial Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units, Hanford Site (100 Area Burial Grounds), Benton County, Washington*). An interim action ROD has not been issued for the 100-FR-3 OU for addressing contaminated groundwater underlying 100-F. However, DOE continues to monitor groundwater contaminant concentrations while waste site remedial actions are conducted.

While action to clean up soil contamination is mandated mainly by the interim action RODs, actions to mitigate impact from facilities have been initiated in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) action memorandum signed by the Tri-Parties (Wagoner et al., 1998, *Action Memorandum for the 105-F and 105-DR Reactor Buildings and Ancillary Facilities, Hanford Site, Benton County, Washington*). The CERCLA action memorandum directed the efforts to place the F Reactor in ISS condition, that is, to place a weather-resistant shell (cocoon) over the reactor to isolate the core before its final disposition (Figure 3-3). The ISS process also minimizes the facility footprint by removing all peripheral reactor buildings and equipment, disposing of the debris properly. An ISS of the F Reactor was initiated in 1998 and completed in 2003 (DOE/RL-2005-45, *Surplus Reactor Final Disposition Engineering Evaluation*).

Appendix B summarizes the data used for interim closure of waste sites are documented in CVPs and RSVPs. These data also describe the current nature and extent of contamination at interim closed waste sites. The primary statistical calculation to evaluate compliance with cleanup standards is the 95 percent upper confidence limit on the arithmetic mean of the data. The data in Appendix B generally include the maximum concentrations and/or concentrations representing the 95 percent upper confidence limit of waste site contaminants of concern for both the shallow and deep zones (0 to 4.6 m [15 ft] and greater than 4.6 m [15 ft] bgs, respectively).

Figure 3-3. 100-F-26 (108-F Pipeline after excavation; 105-F after Interim Safe Storage in background, 2007)

The close-out verification data and background information on the waste sites also will be used in this addendum to support selection of waste sites for additional characterization based on residual concentrations remaining at the site. Characterization efforts planned in this addendum will be used to verify the distribution of remaining contamination and to refine the 100-F/IU-2/IU-6 CSM.

3.3.1 Waste Sites Description and History

As of December 2009, 257 waste sites and two discovery sites (259 total sites) exist within 100-F/IU-2/IU-6. Of these waste sites, 105 are within 100-F and 154 are in the 100-IU-2 and 100-IU-6 OUs. These sites consist mainly of inactive waste sites described as trenches, ditches, cribs, ponds, burial grounds, and unplanned releases. Some of the waste sites have been interim closed out, rejected, not accepted, or identified for no action. These classifications are defined in the Integrated Work Plan, Chapter 2. Table 3-3 summarizes the individual waste site classifications and identifies Cr(VI), Sr-90, and orphan waste sites.

There are 84 accepted sites and two discovery sites in 100-F/IU-2/IU-6. Sites with a status of accepted or discovery are considered unremediated sites in this plan. Documentation to support the disposition or completion of interim remedial action at five of these sites is in progress or has been submitted to the regulatory agencies for approval. The design and active remediation of another 10 sites continues. Remedial actions and site evaluations are being planned for the remaining sites.

Appendix A provides maps with the waste sites and facilities shown. Appendix B provides a description and history for each waste site. Appendix C lists the facilities.

Table 3-3. Summary Information on the Status of 100-F/IU-2/IU-6 Waste Sites

Reclassification Status	Waste Sites	Closed Total	Interim Closed Total	No Action Total	Not Accepted Total	Accepted Total	Discovery Total	Rejected Total
Reclassification of 100-FR-1 Operable Unit Waste Sites								
Closed[c]	None	0						
Interim Closed[d]	100-F-10, 100-F-11, 100-F-16, 100-F-19[a], 100-F-23[b], 100-F-24[b], 100-F-25[ab], 100-F-29[a], 100-F-31[b], 100-F-33[ab], 100-F-34, 100-F-38[a], 100-F-4[b], 100-F-42, 100-F-43[a], 116-F-1[ab], 116-F-10[ab], 116-F-11, 116-F-12[a], 116-F-14[ab], 116-F-15[ab], 116-F-16[ab], 116-F-2[ab], 116-F-3[ab], 116-F-4[ab], 116-F-5, 116-F-6[ab], 116-F-8[a], 116-F-9[b], 126-F-2, 128-F-2[a], 132-F-1[b], 141-C[b], 1607-F2, 1607-F3[a], 1607-F4, 1607-F5, 1607-F6, 1607-F7, 182-F[a], UPR-100-F-1[b], UPR-100-F-2[a], UPR-100-F-3		43					
No Action[e]	100-F-12, 100-F-18, 100-F-36[ab], 100-F-37, **100-F-52**, **100-F-53**, **100-F-54**[b], 100-F-7, 100-F-9, 116-F-7, 132-F-3, 132-F-4, 132-F-5, 132-F-6[a]			14				
Not Accepted[f]	100-F-17, 100-F-21, 100-F-30, 100-F-32, 100-F-6, 116-F-13, 132-F-2				7			
Accepted[g]	100-F-26[a], 100-F-39[a], **100-F-44**, **100-F-45**[a], **100-F-46**, **100-F-47, 100-F-48, 100-F-49, 100-F-51**[ab], **100-F-55**[a], **100-F-56, 100-F-57**[a], 100-F-59, 118-F-8[ab]					14		
Discovery[h]	100-F-58						1	
Rejected[i]	100-F-40, **100-F-41**, 100-F-5, 100-F-8							4
Total 100-FR-1 OU – 83 waste sites		0	43	14	7	14	1	4
Reclassification of 100-FR-2 Operable Unit Waste Sites								
Closed	None	0						
Interim Closed	100-F-15, 100-F-2[b], 100-F-20[b], 100-F-35[ab], 118-F-1[ab], 118-F-2[b], 118-F-3, 118-F-5[b], 118-F-6[b], 118-F-7, 120-F-1, 126-F-1, 128-F-3[ab], 1607-F1		14					
No Action	100-F-14, **100-F-50**, 118-F-4, 128-F-1			4				
Not Accepted	100-F-1				1			
Accepted	None					0		
Discovery	None						0	
Rejected	100-F-28, 118-F-9[b], 600-31							3
Total 100-FR-2 OU – 22 waste sites		0	14	4	1	0	0	3
Reclassification of 100-IU-2 Operable Unit Waste Sites								
Closed	None	0						
Interim Closed	600-128, 600-129, 600-131, 600-132, 600-139, 600-181, 600-190, 600-191, 628-1		9					
No Action	600-201, 600-52, 600-98, 600-99			4				
Not Accepted	600-122, 600-123, 600-126, 600-130, 600-136, 600-138, 600-157, 600-158, 600-159, 600-160, 600-161, 600-162, 600-163, 600-164, 600-165, 600-166, 600-167, 600-170, 600-171, 600-195, 600-196, 600-198, 600-234, 600-304				24			

Table 3-3. Summary Information on the Status of 100-F/IU-2/IU-6 Waste Sites

Reclassification Status	Waste Sites	Closed Total	Interim Closed Total	No Action Total	Not Accepted Total	Accepted Total	Discovery Total	Rejected Total
Accepted	600-100, 600-120, 600-124, 600-125, 600-127, 600-176, 600-182, 600-188, 600-279, **600-293, 600-294, 600-295, 600-296, 600-297, 600-298, 600-299, 600-300, 600-301, 600-302, 600-303, 600-305, 600-306, 600-307, 300-308, 600-309, 600-310, 600-311, 600-312, 600-341, 600-342, 600-343, 600-344, 600-345, 600-346**, 600-5					35		
Discovery	None						0	
Rejected	600-121, 600-135, 600-172, 600-173, 600-174, 600-175, 600-177, 600-179, 600-180, 600-183, 600-184, 600-189, 600-193, 600-194, 600-199, 600-200, 600-203, 600-209, 600-263							19
Total 100-IU-2 OU – 91 waste sites		0	9	4	24	35	0	19
Reclassification of 100-IU-6 Operable Unit Waste Sites								
Closed	UPR-600-11	1						
Interim Closed	600-111, 600-204, 600-23, JA JONES 1, UPR-600-16		5					
No Action	600-107, 600-110, 600-208, 600-239			4				
Not Accepted	600-153, 600-168, 600-169, 600-192, 600-250, 600-251				6			
Accepted	600-108, 600-109, 600-146, 600-149, 600-178, 600-186, 600-202, 600-205, 600-213, 600-257, 600-272, 600-3, **600-313, 600-314, 600-315, 600-316, 600-317, 600-318, 600-319, 600-320, 600-321, 600-322, 600-323, 600-324, 600-325, 600-326, 600-327, 600-328, 600-329, 600-330, 600-331, 600-332, 600-333, 600-334, 600-335**					35		
Discovery	600-280						1	
Rejected	600-185, 600-20, 600-206, 600-207, 600-24, 600-240, 600-26, 600-27, 600-50, UPR-600-18, UPR-600-19							11
Total 100-IU-6 OU – 63 waste sites		1	5	4	6	35	1	11
Total – 259 waste sites		1	71	26	38	84	2	37

Note: Additional information provided in Appendix B.

This summary is current as of December 2009 (Stewardship Information System). WIDS waste site definitions originate from the *Tri-Party Agreement Handbook Management Procedures* Guideline Number TPA-MP-14 (RL-TPA-90-0001).

Bold text denotes a site identified through the orphan site evaluation process.

a. Site received chromium waste stream.

b. Site received Sr-90 waste stream.

c. Closed: A reclassification status indicating that due to actions taken, a waste management unit meets applicable cleanup standards or closure requirements. (Note: Many remediation waste sites were identified as "Closed Out" based on a previous classification scheme. Since all the associated RODs are interim action RODs, these waste sites are considered "Interim Closed" based on current definitions.)

d. Interim Closed Out: A reclassification status indicating, due to actions taken, a waste management unit meets cleanup standards specified in an Interim Action Record of Decision or Action Memorandum, but for which a Final Record of Decision has not been issued.

e. No Action: A reclassification status indicating a waste site does not require any further remedial action under *Resource Conservation and Recovery Act of 1976* (RCRA) Corrective Action, *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), or other cleanup standards based on an assessment of quantitative data collected for the waste site.

f. Not Accepted: A classification status indicating an assessment has been made that a WIDS site is not a waste management unit and is not within the scope of Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*, Section 3.1. This classification requires lead regulatory agency approval.

g. Accepted: A classification status indicating an assessment has been made that a WIDS site is a waste management unit as defined in the Tri-Party Agreement Action Plan (Ecology et al., 1989b), Section 3.1.

h. Discovery: An initial classification status indicating evidence of a potential waste site; assessment is not yet complete. This is the classicization of a newly discovered WIDS site.

i. Rejected: A classification status indicating that a waste site does not require remediation under RCRA Corrective Action, CERCLA, or other cleanup standards based on qualitative information such as a review of historical records, photographs, drawings, walkdowns, ground penetrating radar scans, and shallow test pits. Such investigations do not include quantitative measurements.

OU = operable unit

The use and evolution of onsite facilities and their roles in waste management operations are described more completely in other technical documents (WHC-SD-EN-TI-169; DOE/RL-93-83, *Limited Field Investigation Report for the 100-FR-3 Operable Unit*). Specific site information obtained from contemporary characterization and remediation activities is available from WIDS. Waste sites scheduled to be revegetated as part of recent (calendar year 2008-2009) remediation actions include 118-F-6, 100-F-36, 128-F-2, 120-F-1, 100-F-38, 1607-F-1, 1607-F-3, and 100-F-26.

3.3.2 Riparian Area Contamination

The 100-F-59 waste site, riparian area contamination originating from 128-F-2, was created from two riparian areas that are known to contain contaminants above soil remedial action goals. Figure 3-4 shows the first area is a portion of the former 128-F-2 burn pit (Area C) and the second area is located in riparian areas east and southeast of Area C.

Initial remediation of the 128-F-2 waste site was performed from August to October 2005. Remediation activities from October 2006 to February 2007 preceded toward the river where material at and below the ordinary high water mark was removed. The portion of the 128-F-2 waste site below the ordinary high water mark is referred to as Area C. Immediately after verification sampling of Area C in February 2007, which showed elevated levels of several metals and pesticides, gravel was added to the excavated surface below the ordinary high water mark to stabilize the underlying sediments prior to spring high river flows.

In January 2008, additional sampling of riparian areas surrounding the 128-F-2 waste site was conducted in accordance with WCH-227, *Sampling and Analysis Instruction for Evaluation of the Distribution of Metals in the Sediments at 128-F-2 Waste Site.* Three distinct sampling areas were established based on proximity to the waste site, river flow patterns, and local topography (Figure 3-5). Sampling results are as follows:

- Near Waste Site: Samples were taken from 18 locations. In these samples, arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc were detected at levels exceeding soil background or soil remedial action goals. Both dichlorodiphenyldichloroethylene (4,4-DDE) and dichlorodiphenyltrichloroethane (4,4'-DDT) were detected at levels above groundwater/river remedial action goals. It is noted that chromium, lead, and zinc concentrations exceeding Hanford background soil values were also measured in samples taken upstream of the 128-F-2 waste site. The contamination at these upstream locations is not attributed to the 128-F-2 waste site.
- North Shore: Samples were taken from 16 locations. Arsenic, cadmium, chromium, copper, lead, and zinc were detected at levels exceeding soil background or soil remedial action goals.
- Slough Area: Samples were taken from seven locations. Arsenic, chromium, Cr(VI), copper, lead, nickel, and zinc were detected at levels exceeding soil background or soil remedial action goals. Alpha radiation and Cs-137 were also detected, indicating that the contamination has entered the slough from upstream reactor areas.

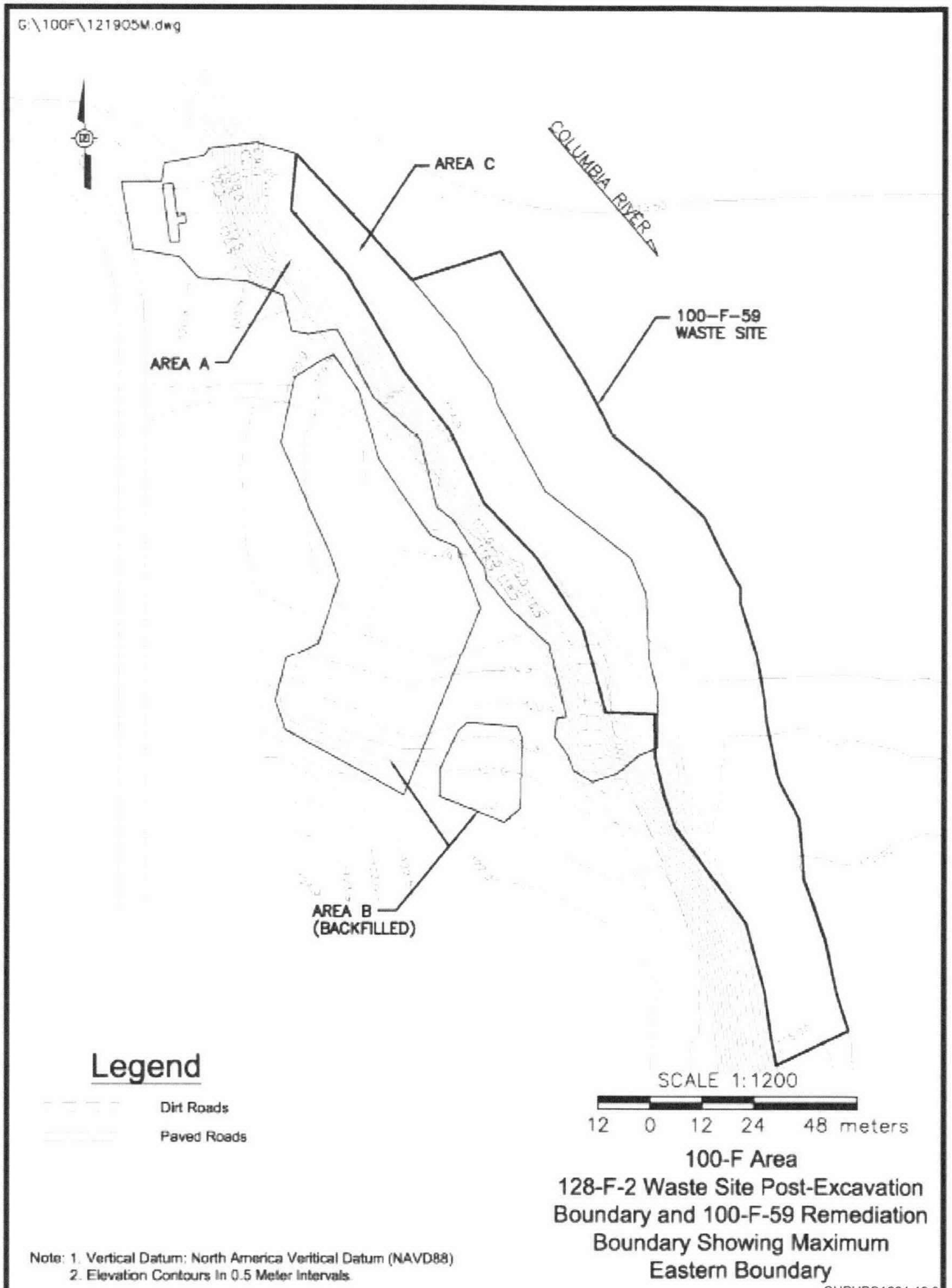
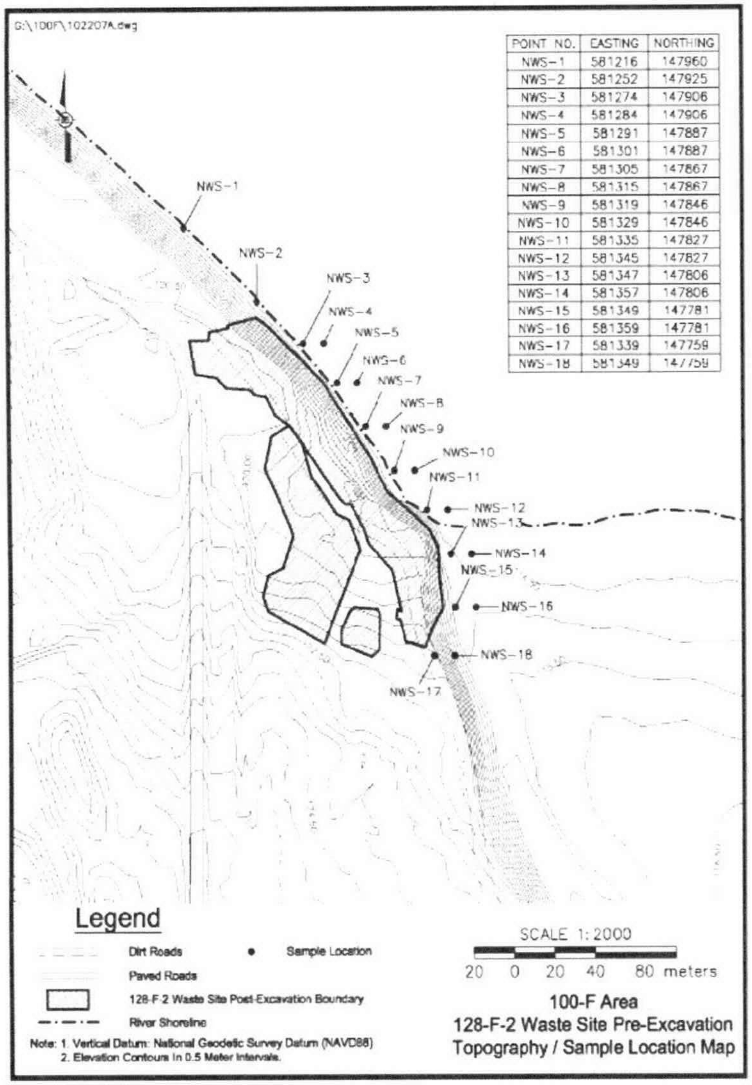


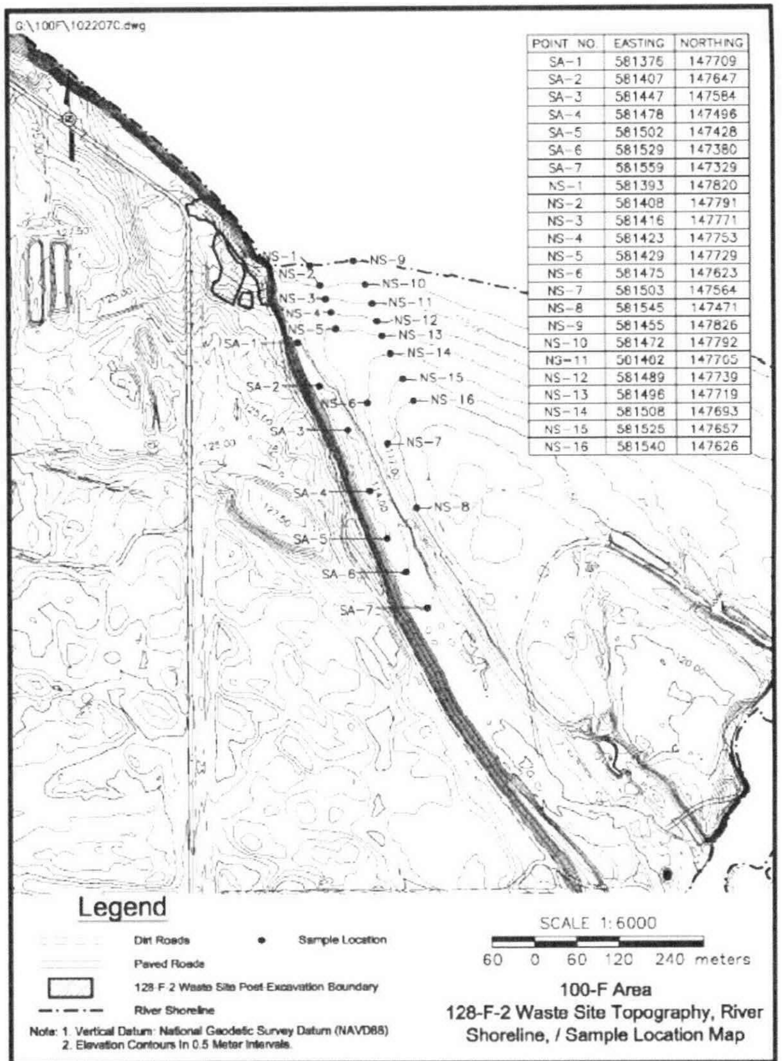
Figure 3-4. Area of 100-F-59 Waste Site Showing Maximum Eastern Boundary and Location of the 128-F-2 Waste Site Area C



POINT NO.	EASTING	NORTHING
NWS-1	581216	147960
NWS-2	581252	147925
NWS-3	581274	147906
NWS-4	581284	147906
NWS-5	581291	147887
NWS-6	581301	147887
NWS-7	581305	147867
NWS-8	581315	147867
NWS-9	581319	147846
NWS-10	581329	147846
NWS-11	581335	147827
NWS-12	581345	147827
NWS-13	581347	147806
NWS-14	581357	147806
NWS-15	581349	147781
NWS-16	581359	147781
NWS-17	581339	147759
NWS-18	581349	147759

100-F Area
128-F-2 Waste Site Pre-Excavation Topography / Sample Location Map

NWS = Near Waste Site



POINT NO.	EASTING	NORTHING
SA-1	581376	147709
SA-2	581407	147647
SA-3	581447	147584
SA-4	581478	147496
SA-5	581502	147428
SA-6	581529	147380
SA-7	581559	147329
NS-1	581393	147820
NS-2	581408	147791
NS-3	581416	147771
NS-4	581423	147753
NS-5	581429	147729
NS-6	581475	147623
NS-7	581503	147564
NS-8	581545	147471
NS-9	581455	147826
NS-10	581472	147792
NS-11	501402	147705
NS-12	581489	147739
NS-13	581496	147719
NS-14	581508	147693
NS-15	581525	147657
NS-16	581540	147626

100-F Area
128-F-2 Waste Site Topography, River Shoreline, / Sample Location Map

CHPUBS1004-19.10

NS = north shore
SA = slough area

Figure 3-5. Near Waste Site, North Shore, and Slough Area Sampling Locations in Riparian Areas of the 100-F-59 Waste Site

3.3.3 100-F/IU-2/IU-6 Waste Site Remediation

Considerable remediation has been completed at 100-F/IU-2/IU-6. As of December 2009, 173 waste sites had been remediated or determined to require no further action. Chapter 2 summarizes the status of facilities and waste sites in 100-F/IU-2/IU-6. Approximately 977 million kg (1.07 million tons) of contaminated soil and debris have been removed from wastes sites located in 100-F/IU-2/IU-6 and disposed at ERDF. Figure 3-6 illustrates the extent of RTD activities accomplished in 100-F. At least 363 vadose zone samples (with about corresponding 20,350 records) have been collected as part of waste site remediation to verify cleanup and document interim closure status. Eighty-four accepted waste sites and an additional two discovery sites remain to be dispositioned. Source OU interim remedial actions are scheduled to be completed by the end of December 2011.

Figure 3-6. 100-F Area Waste Site Excavation Activities

The impact of Hanford site-specific past practices in the 100-IU-2 and 100-IU-6 OUs is limited in nature, and are predominantly nonradioactive. Most identified waste sites in this area can be traced to pre-Hanford activities (agricultural, domestic) or non-production-related activities such as temporary worker housing or security. Extensive investigations have been conducted to identify most of these sites as pre-Hanford or non-production-related features.

Additional waste sites are related to either the Manhattan Project or late Hanford Site operations that have required or will require additional investigation and/or remediation. The 600-111 waste site, located in the 100-IU-6 OU and site of the former P-11 Critical Mass Laboratory, crib, septic system, and underground piping, had an incident of plutonium release in the facility. The contamination was limited to shallow soil and has since been remediated. Figures 3-7 and 3-8 show the recent remedial activities at 600-111. The P-11 project was developed as an experimental facility to support proper design of new chemical separation facilities in the 200 Area process. The laboratory, crib, and underground piping were decontaminated and demolished in 1974. Further remedial action (RTD of contaminated soil followed by verification sampling) was undertaken at the 600-111 waste site in 2008.

Figure 3-7. Remediation of 600-111 Waste Site in the 100-IU-6 Operable Unit in 2008

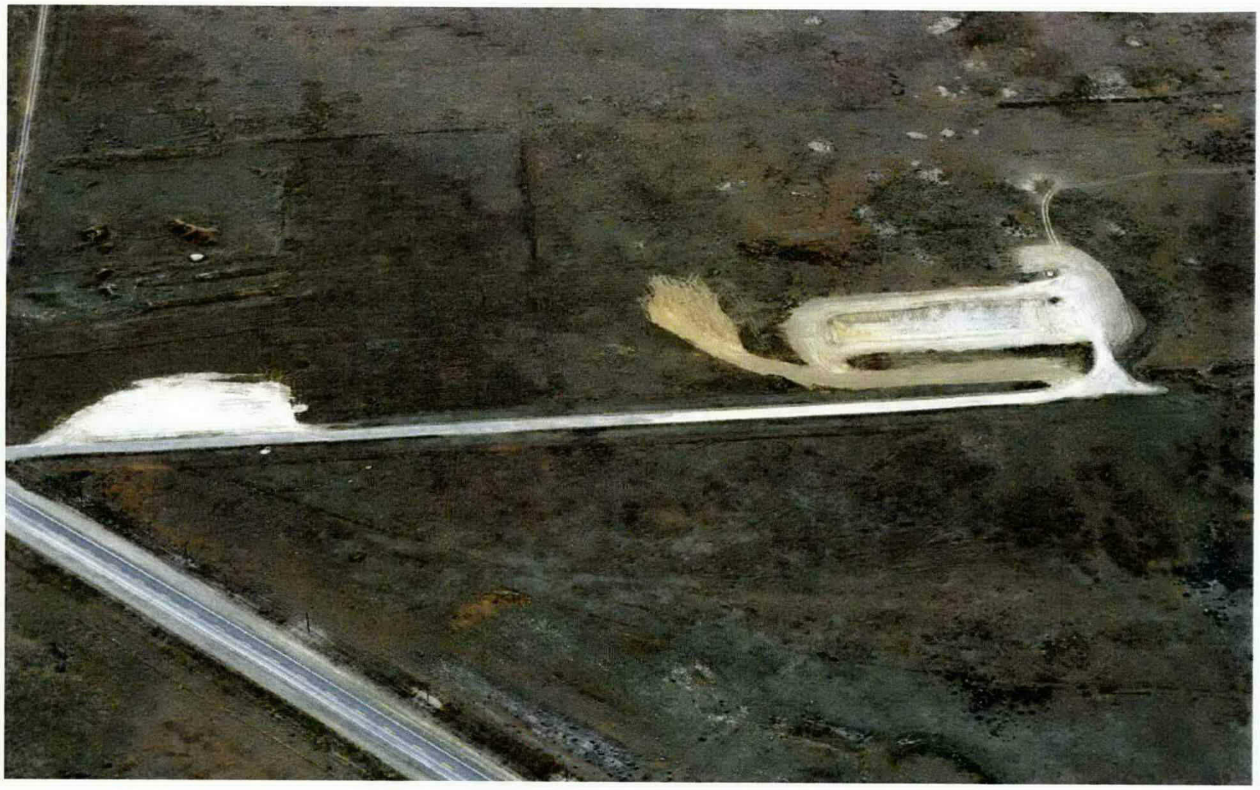


Figure 3-8. Aerial View of the 600-111 Waste Site after Remediation

3.4 Nature and Extent of Groundwater Contaminants

This section describes the nature and extent of groundwater contamination within the 100-F/IU-2/IU-6 Areas. More detailed information on the groundwater is presented in Annual Hanford Site Groundwater Monitoring Reports (e.g., DOE/RL-2008-66, *Hanford Site Groundwater Monitoring for Fiscal Year 2008*). Hanford Site hydrogeology at 100-F and 100-IU-2/IU-6 is discussed in Section 2.1.3.

Groundwater monitoring projects are established under DOE Order 5400.1 to meet the requirements of DOE Order 5400.5, Chg 2, *Radiation Protection of the Public and the Environment*, which deals with radiation protection of the public and the environment, and federal and state regulations. The Tri-Party Agreement is a legally binding document that is used to coordinate groundwater protection and remedial action efforts (Ecology et al., 1989a, *Hanford Federal Facility Agreement and Consent Order*).

Groundwater monitoring has been conducted on the Hanford Site since the 1940s. Very few monitoring wells existed in the early decades of operation at 100-F (approximately four wells dating from the 1940s, 1950s, and 1960s remain in service there), but more were installed in the early 1990s as needed for CERCLA investigations and cleanup activities.

A summary of the results of previous groundwater monitoring are presented in the following subsections. Locations of groundwater monitoring wells are shown in Appendix A. Wells in 100-F are sampled for the contaminants of concern based on results of the data quality objectives process (PNNL-14287, *Data Quality Objectives Summary Report – Designing a Groundwater Monitoring and Assessment Network for the 100-BC-5 and 100-FR-3 Operable Units*). The monitoring program is described in DOE/RL-2003-49, *100-FR-3 Operable Unit Sampling and Analysis Plan*. Wells in the IU-2 and IU-6 OUs are monitored according to requirements determined for the 200-BP-5 and 200-PO-1 OUs (DOE/RL-2001-49, *Groundwater Sampling and Analysis Plan for the 200-BP-5 Operable Unit* and DOE/RL-2003-04, *Sampling and Analysis Plan for the 200-PO-1 Operable Unit*).

Groundwater samples are collected every 1 to 3 years, depending on location. Groundwater data are used to create maps and plots that illustrate groundwater flow, water table elevations, hydrogeochemistry, and contaminant concentration trends and distribution. The results are published annually in the annual Hanford Site Groundwater Monitoring Report (e.g., DOE/RL-2008-66).

Facilities and waste sites in 100-F received or discharged chemicals and radionuclides from the 1940s to the 1960s. Previous groundwater investigations indicate that Cr(VI), Sr-90, nitrate, and trichloroethene (TCE) have reached the groundwater from vadose zone sources at concentrations in excess of federal and/or state drinking water standards, or aquatic standards considered protective of the river. In addition, contaminants such as aluminum, iron, and manganese exceed secondary drinking water standards.

3.4.1 100-FR-3 Operable Unit Groundwater Limited Field Investigation

In 1992 and 1993, as part of the RI/FS process, an LFI was conducted to define the nature and extent of hazardous and radioactive materials in groundwater and to evaluate the applicability of interim remedial measures for reducing human health and environmental risks posed by the 100-FR-3 groundwater OU (DOE/RL-93-83). Thirteen groundwater monitoring wells were installed as part of this effort.

Deep well 199-F5-43B was drilled 46 m (150 ft) into the Ringold Formation and screened in the upper confined/semi-confined aquifer (WHC-SD-EN-TI-221); the well did not reach basalt (DOE/RL-93-83). Twelve wells (199-F1-2, 199-F5-42, 199-F53-43A, 199-F5-44, 199-F5-45, 199-F5-46, 199-F5-47, 199-F5-48, 199-F6-1, 199-F7-3, 199-F8-3, and 199-F8-4) were screened across the water table in the Hanford formation.

The rationale for each well location is presented in the RI/FS Work Plan for 100-FR-3 (DOE/RL-91-53). Gravels, cobbles, and boulders limited drilling options to cable tool methods. Soil samples were collected at 1.5 m (5 ft) intervals and at major lithologic changes (i.e., geologic unit contacts and changes in the grain size of the materials).

Groundwater samples were collected for analysis after well installation and development, except at 199-F5-43B, which could not be properly developed. In addition, seven shallow wells that were already present were sampled as part of the LFI. Thus, 19 wells were sampled during the investigation. Downhole radiological contaminants were surveyed using geophysical techniques. Groundwater samples were analyzed for CERCLA Contract Laboratory Program (CLP) target compound and target analyte lists, specific anions that might be present, and radionuclides. Analytical results for groundwater were screened to identify contaminants of potential concern (COPCs) to be analyzed further through a qualitative risk assessment (QRA) process. The resulting, refined list of COPCs included arsenic, chromium, manganese, nitrate/nitrite, Sr-90, and tritium (DOE/RL-93-83). The ecological risk assessment identified chromium, copper, and lead as COPCs. Although trichloroethene was not identified by the QRA as a risk driver, it was carried forward because it exceeded the 40 CFR 141, "National Primary Drinking Water Regulations". The results of the QRA are discussed in Section 3.3.3.

3.4.2 Groundwater/Soil Gas Supplemental Limited Field Investigation Report (1996)

In groundwater samples taken in 1994, TCE was detected at levels in excess of the EPA drinking water standard of 5 μg/L. A supplemental LFI was conducted to determine the extent and potential source(s) of TCE groundwater contamination (DOE/RL-95-99, *100-FR-3 Groundwater/Soil Gas Supplemental Limited Field Investigation Report*). The shallow TCE groundwater plume exceeding EPA and Ecology drinking water standards was identified and delineated, and the highest observed groundwater concentration (at the time) was 52 μg/L.

Forty-nine sampling locations were established in an area west of 100-F, covering about 5.2 km^2 (2 mi^2). From those identified locations, 40 soil gas samples and 41 groundwater samples were collected using a hydraulic probe driver. In addition, groundwater samples were collected from 10 existing groundwater monitoring wells in the area. Relatively low concentrations of TCE were detected in soil gas collected from the vadose zone throughout the study area. The highest concentration of TCE in soil gas was 77 parts per billion by volume.

The locations of elevated TCE soil gas detections in the study area did not appear to coincide with potential or observed sources of TCE contamination, and soil gas concentrations did not show a positive correlation with groundwater TCE concentrations. However, the lateral extent of TCE detected in the vadose zone soil gas correlated directly with the lateral extent of the TCE plume in the underlying groundwater. Additionally, the zones of elevated soil gas TCE concentrations were found to be upgradient of and adjacent to zones of elevated TCE in groundwater.

A human health and ecological QRA for TCE based on data gathered during this study, along with previously obtained data, categorized risk to human, riparian, or aquatic organisms as low (i.e., for human health, incremental cancer risk [ICR] is between 10^{-6} and 10^{-4}; and for ecological, Ecological Hazard Quotient [EHQ] is less than 1.0).

3.4.3 Qualitative Risk Assessment

In 1992 and 1993, a QRA was completed for the 100-FR-3 Groundwater OU (WHC-SD-EN-RA-012, *Qualitative Risk Assessment for the 100-FR-3 Groundwater Operable Unit*) that screened COPCs identified during the LFI for human-health and ecological risks. Using a predefined set of human and environmental exposure scenarios, the QRA assessed the risk to human health and ecological receptors posed by the groundwater and the discharge of groundwater contaminants to the Columbia River. Four non-carcinogenic COPCs have Hazard Quotients (HQs) for human health above 1.0 as part of the frequent use scenario: aluminum, arsenic, manganese, and nitrate/nitrite. The HQ is the ratio of a contaminant exposure estimate to a concentration considered to represent a safe environmental concentration or dose. Under the occasional use scenario, the HQ is less than 1.0 for all COPCs.

Nine carcinogenic COPCs were identified and evaluated as part of the frequent use scenario. The risk associated with each COPC and the total risk from all COPCs were calculated. Under the frequent use scenario, the total risk estimated by ICR calculations is medium (ICR between 10^{-4} and 10^{-2}). The inorganic constituent arsenic and radionuclides Sr-90 and tritium also have medium risk estimations. Organic constituents chloroform and TCE and radionuclides C-14, uranium -233/234, and uranium-238 had low risk estimates (ICR between 10^{-6} and 10^{-4}); and uranium -235 had a very low risk estimate (ICR less than or equal to 10^{-6}).

Near-river groundwater samples were also evaluated for aquatic toxicity to fish from non-radioactive contaminants. The EHQ for non-radionuclides (hazardous chemicals) indicates that the chronic EHQs, based on near-river well concentrations, exceeded 1.0 for Cr(VI), lead, and copper. The acute EHQ exceeded 1.0 for Cr(VI). No radionuclide dose exceeded the levels established in DOE Order 5400.5, *Environmental Surveillance*. For all radionuclides evaluated, none exceeded an EHQ of 1.0.

The QRA further determined a medium to low risk for identified contaminants in groundwater under the frequent use scenario and low to very low risk for identified contaminants under the occasional use scenario detected. As a result, no interim remedial measure for groundwater has been undertaken. However, the OU was recommended to remain on the interim remedial measure pathway, and remedial actions at the 100-FR-3 Groundwater OU will be coordinated with the remediation of the overlying source units (100-FR-1 and 100-FR-2 OUs).

Continued groundwater quality monitoring was proposed with a provision to recalculate risk if contaminant concentrations increased. Post-source-remediation activities would include groundwater re-evaluation to identify potential risk reduction resulting from the remedial activities. The QRA results suggest re-evaluation activities should be conducted in tandem with the ongoing RI/FS and D4 activities (WHC-SD-EN-RA-012).

3.4.4 Groundwater Monitoring Results

Groundwater monitoring requirements for 100-F and IU-2/IU-6 are described in DOE/RL-2003-49, DOE/RL-2001-49, and DOE/RL-2003-04. The results are documented in annual groundwater monitoring reports prepared for the Hanford Site (e.g., DOE/RL-2008-66). A summary of recent results (samples from 2008 and 2009) follows. The discussion focuses on nitrate, Sr-90, Cr(VI), and TCE, which have sources in or near 100-F. Groundwater in the IU-2 and IU-6 area is contaminated with tritium, I-129, technetium-99, and nitrate, but the sources of those contaminants are in the 200 Areas, and remediation of those contaminants is addressed in the 200 Area documents.

3.4.4.1 Nitrate

Groundwater concentrations of nitrate in 100-F continued to exceed the drinking water standard (45 mg/L) in 2008 and 2009. A large nitrate plume extends southward approximately 5 km (3 mi) from 100-F (Figure 3-9). The influence of the paleo-channel described in *Geology and Groundwater Quality Beneath the 300 Area, Hanford Site, Washington* (PNL-2949), as well as the history of the EAF are suspected to contribute to the inland extent of this plume.

Nitrate in groundwater within the 100-IU-2/IU-6 region extends northwestward from the 200 East Area through Gable Gap at concentrations generally less than the drinking water standard of 45 mg/L. Nitrate concentrations in the eastern portion are also generally less than the drinking water standard.

3.4.4.2 Strontium-90

Strontium-90 concentrations exceeded the federal drinking water standard (8 pCi/L) beneath the portion of 100-F in the vicinity of the 116-F-14 Retention Basin and the nearby disposal trenches in 2008 and 2009 (Figure 3-10). The extent of the plume has not changed significantly in the past 10 years, and most wells are sampled for Sr-90 every other year. Well 199-F5-1 has the highest Sr-90 concentrations (25.8 pCi/L in 2007 and 12.0 pCi/L in 2009). The concentration in well 199-F5-1 exceeded the standard in 2007 (8.25 pCi/L) but dropped below the standard in 2009 (3.5 pCi/L). A few other wells had detectable Sr-90, but concentrations were less than the drinking water standard. Overall, the contamination trends are stable or declining.

Strontium-90 shows vertical stratification in the only shallow/deep well pair in 100-F. Deep well 199-F5-43B (screened in the RUM) consistently has no detectable Sr-90, while its shallow counterpart, well 199-F5-43A, typically has 2 to 4 pCi/L of Sr-90.

In 100-F, the Sr-90 concentrations remained below the drinking water standard in aquifer tubes during 2008 and 2009. The highest value in 2009 was 5.4 pCi/L in tubes AT-F-1-M and C6302. Generally, the shallow and mid-depth aquifer tubes have higher Sr-90 concentrations than deep aquifer tubes.

Strontium-90 is detected north of the 200 East Area and just south of Gable Mountain and is part of the 200-BP-5 OU. The area of groundwater contaminated at concentrations greater than the drinking water standard was approximately 0.65 km^2 (0.251 mi^2) in 2008 (DOE/RL-2008-66).

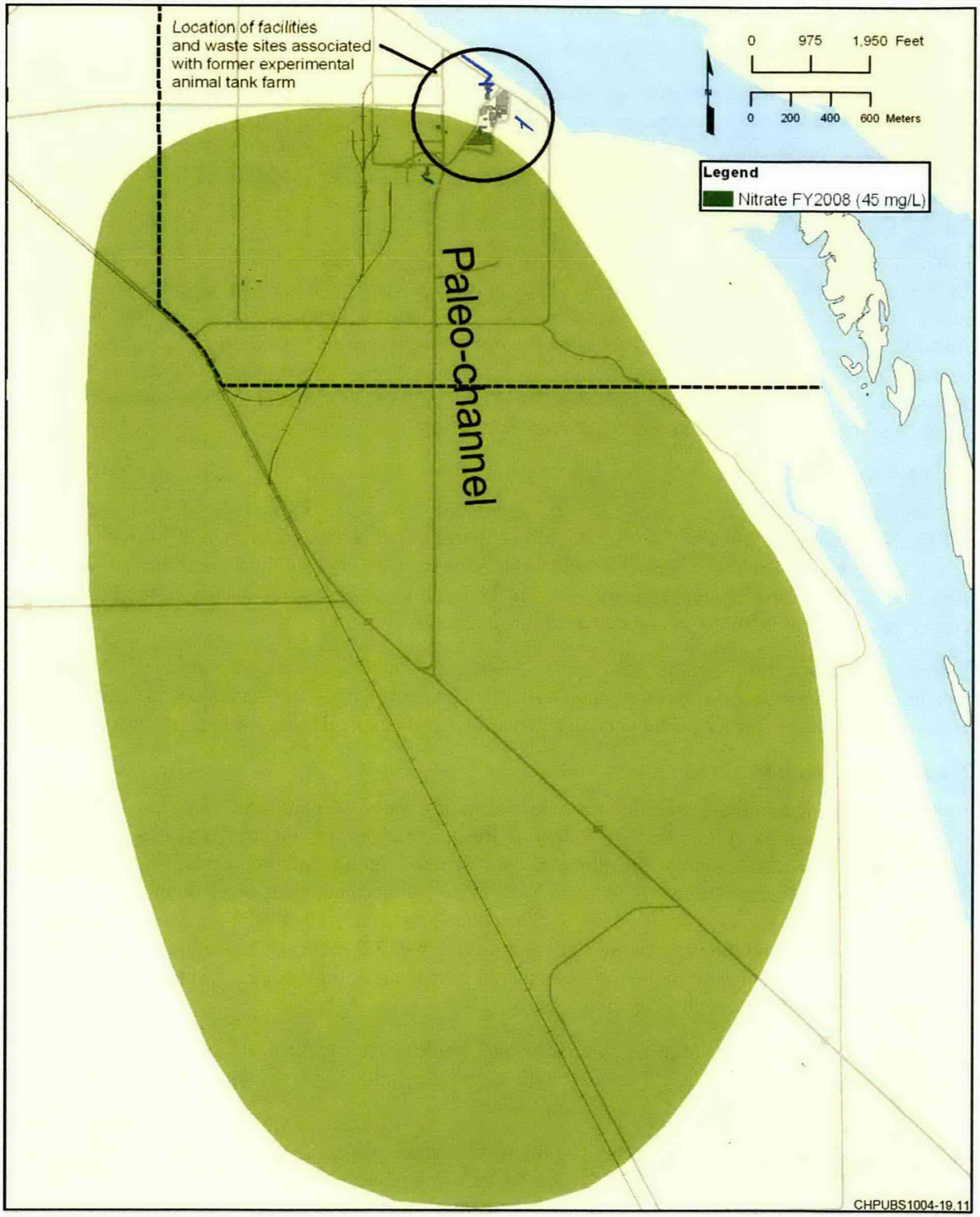


Figure 3-9. Nitrate Plume in Groundwater South of 100-F

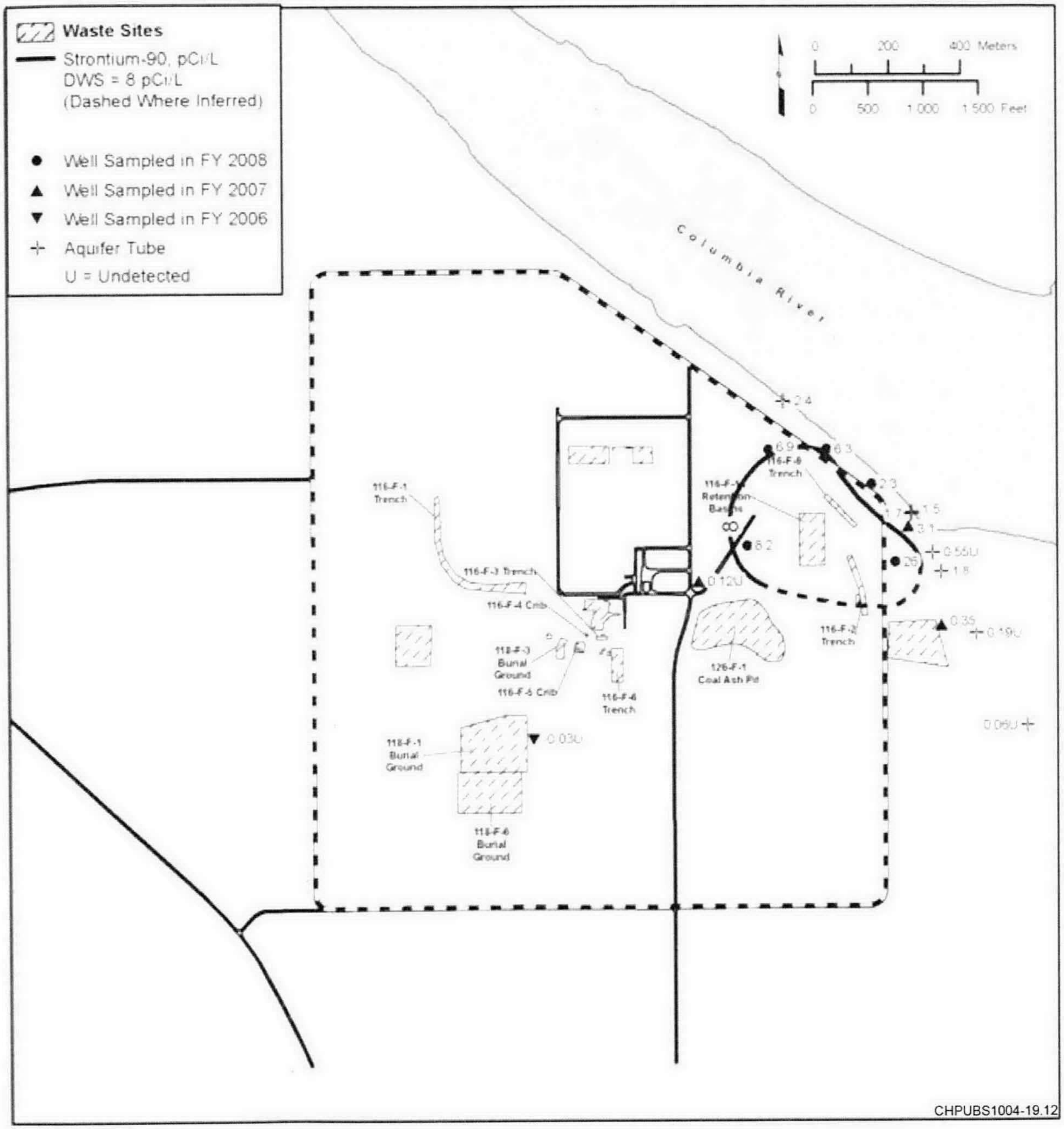


Figure 3-10. Strontium-90 Concentrations in 100-F, Upper Part of Unconfined Aquifer (Average of 2008 Values; *DOE/RL-2008-66, Hanford Site Groundwater Monitoring Report for Fiscal Year 2008*)

3.4.4.3 Tritium

Tritium concentrations beneath 100-F did not exceed the federal drinking water standard of 20,000 pCi/L in 2008 or 2009. Historically only Well 199-F8-3, near the 118-F-1 Burial Ground, has exceeded the tritium drinking water standard, where concentrations were nearly 180,000 pCi/L in the mid-1990s. Since then, concentrations have steadily declined. In 2009, the tritium concentration at well 199-F8-3 was 3,200 pCi/L. The plume appears to have migrated southward into 100-IU-2/IU-6 at concentrations below the drinking water standard.

A tritium plume that originated from the 200-BP-5 Groundwater OU extends through Gable Gap at concentrations less than the drinking water standard, and then between 100-BC and 100-K to the Columbia River. A second plume that originated in the 200-PO-1 OU extends from the 200 East Area eastward to the Columbia River at concentrations exceeding the drinking water standard. Figure 2-3 shows the general plume location.

3.4.4.4 Trichloroethene

Trichloroethene concentrations in southwestern 100-F (Figure 3-11) exceed the federal and state drinking water standards, which are both 5 μg/L, but detected concentrations are declining. In 2009, samples from only three wells exceeded the drinking water standard, with the highest concentration in Well 199-F7-1 (13 μg/L).

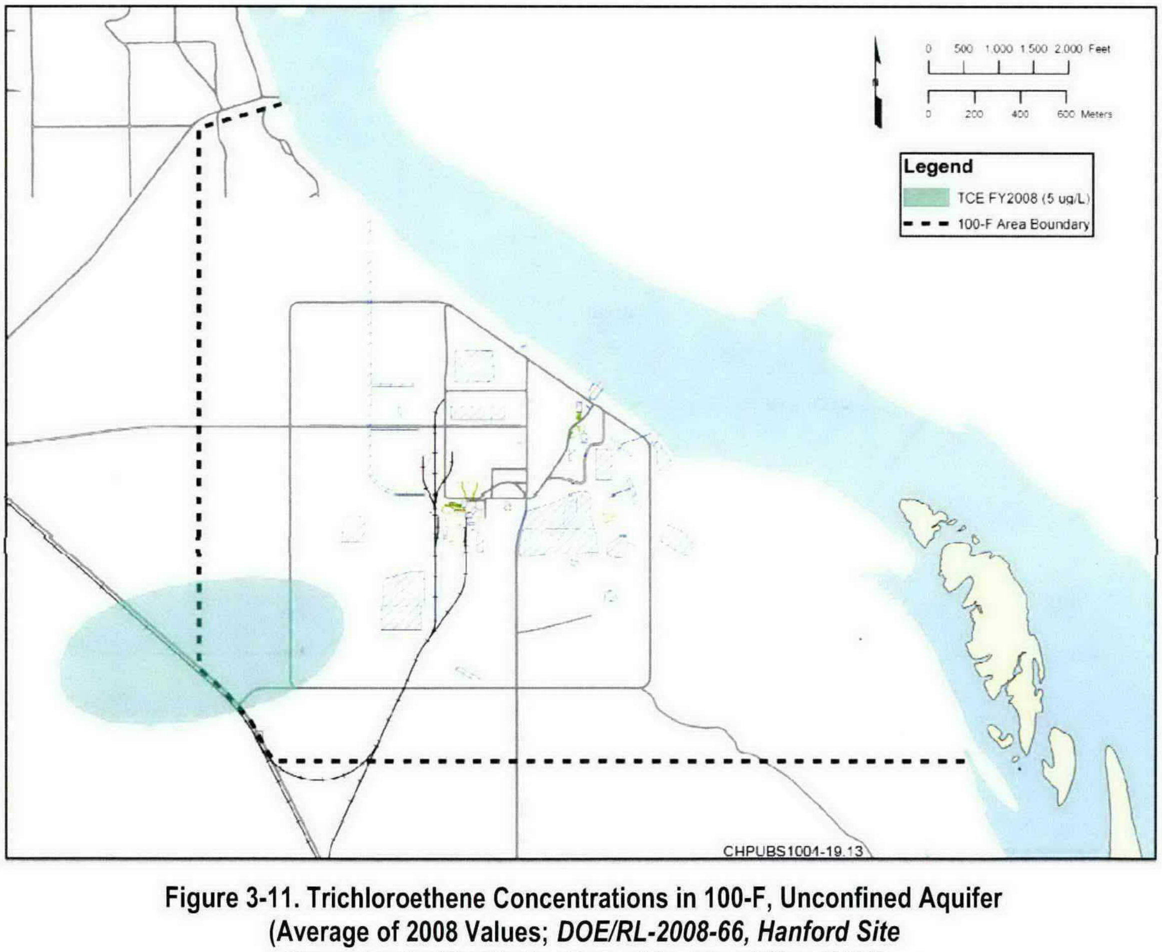


Figure 3-11. Trichloroethene Concentrations in 100-F, Unconfined Aquifer (Average of 2008 Values; *DOE/RL-2008-66, Hanford Site Groundwater Monitoring Report for Fiscal Year 2008*)

3.4.4.5 Uranium and Gross Alpha

Uranium and gross alpha concentrations in 100-F wells sampled in 2008 or 2009 remained below federal drinking water standards (30 µg/L and 15 pCi/L, respectively). The maximum uranium concentration was 17.9 µg/L in Well 199-F8-4. This well also had the highest gross alpha concentration, 12 pCi/L.

3.4.4.6 Hexavalent Chromium

Groundwater in 100-F is primarily analyzed for total chromium in unfiltered and filtered samples. Total chromium results from filtered samples are equivalent to the Cr(VI) concentrations. In 2008 and 2009, chromium concentrations were reported at less than the drinking water standard of 100 µg/L for total chromium (which includes both hexavalent and trivalent chromium). The concentration in one well exceeded the Washington State Model Toxics Control Act (MTCA) Method B standard of 48 µg/L for Cr(VI) (Well 199-F5-6, 54 µg/L in 2009) (WAC 173-340-705).

The Cr(VI) ambient water quality criterion is 10 µg/L. During interim action implementation for other portions of the 100 Area, it was agreed that a 1:1 dilution factor could be applied to groundwater entering the Columbia River (EPA/AMD/R10-00/122). Applying the near-shore dilution attenuation factor of 1:1 to the surface water quality concentration yields a remedial action goal of 20 µg/L, with near-shore groundwater as the river protection compliance point. This 1:1 dilution agreement will be re-evaluated for final ROD development.

Three wells (199-F5-6; 199-F5-44; 199-F5-46), located near the 116-F-14 Retention Basins and the 116-F-9 Trench, had chromium concentrations above 20 µg/L in 2008 and 2009 (Figure 3-12).

As with the other parts of the 100 Area, Cr(VI) contamination is of concern to aquatic life in the Columbia River adjacent to 100-F/IU-2/IU-6. Salmon spawning areas are located adjacent to 100-F, and are discussed in Section 3.8.7. In addition, the river provides habitat for a variety of other fish species, aquatic invertebrates, and aquatic plants.

The only aquifer tubes in or near 100-F with chromium concentrations above 10 µg/L in 2009 were tube C6303 (near the known groundwater plume) at 14.7 µg/L and tube 75-D (approximately 2 km [1.2 mi] downstream) at 11.3 µg/L.

3.4.4.7 Other Contaminants

Other groundwater contaminants observed in the area are principally plumes from past disposal practices within 200 East that have migrated into parts of 100-F/100-IU-2/IU-6 (but are now part of the 200-PO-1 and 200-BP-5 Groundwater OUs). These plumes include tritium, I-129, and Tc-99.

- Tritium and Iodine-129 exceed drinking water standards in a large plume east and southeast of 200 East.
- Technetium-99 and iodine-129 plumes are observed northwest of 200 East. However, concentrations north of the gap between Gable Mountain and Gable Butte are below drinking water standards.

3.5 Contaminant Fate and Transport

This section discusses the fate and transport of contaminants in the vadose zone and groundwater within 100-F/IU-2/IU-6. Contaminants remaining in the vadose zone may migrate to groundwater and ultimately to the Columbia River.

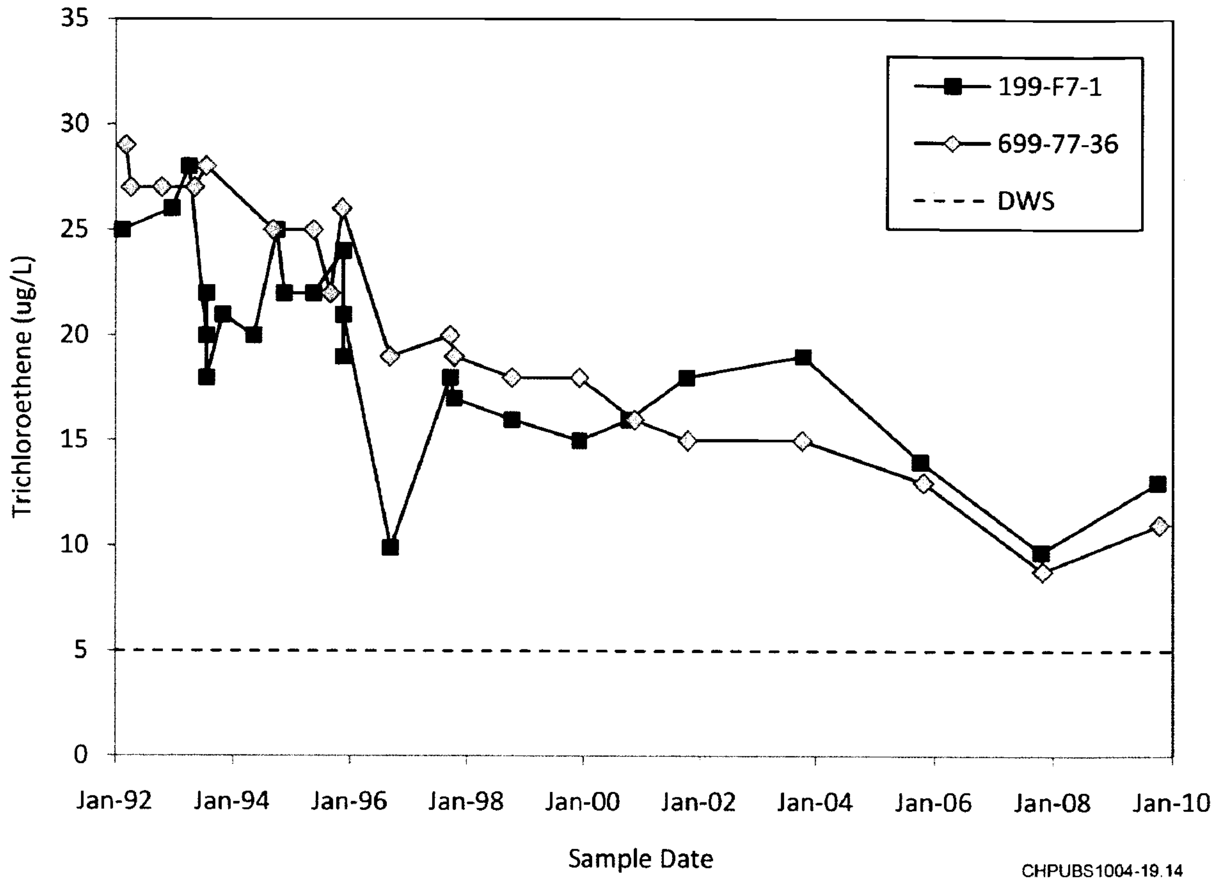


Figure 3-12. Chromium Concentrations in 100-F, Upper Part of Unconfined Aquifer (Average of 2008 Values; *DOE/RL-2008-66, Hanford Site Groundwater Monitoring Report for Fiscal Year 2008*)

3.5.1 Contaminant Distribution in the Vadose Zone

The primary physical and chemical properties that influence contaminant distribution in the vadose zone are the volume of effluent discharged, contaminant inventory, vadose zone thickness, stratigraphy, K_d, and natural recharge.

The generalized contaminant distribution model for 100-F/IU-2/IU-6 is based on the observed distribution of contamination, and information on recharge histories and contaminant chemical reactivity with subsurface sediments that are to some degree waste site-specific. Effluent discharged to the soil column provided the primary driving force for contaminant migration during operations. Where saturated conditions were maintained during operation, the extent of contamination is most extensive. Since cessation of waste discharges, only natural recharge and, in some cases, artificial sources of recharge are available to facilitate continued contaminant transport. Artificial discharges include the use of water for dust suppression.

Waste sites that received enough liquid effluent to impact groundwater have contamination at varying elevations throughout most of the vadose zone. Contaminants with low distribution coefficients (near zero), such as Cr(VI), migrated through the vadose zone and into the groundwater when the waste sites were operational, and available data indicate that residual concentrations of Cr(VI) remain in the deep vadose zone. Data are not available to evaluate the extent of other mobile contaminants, notably tritium and nitrate, throughout the thickness of the vadose zone. Concentrations of less-mobile contaminants generally decrease with depth below the disposal structure.

Wastes sites that received small amounts of dilute liquids are generally found to have soil contamination extending limited distances into the vadose zone beneath them (i.e., burial grounds, reactor structures, and some unplanned releases). Adverse impacts to groundwater from these sources are not expected where the vadose zone is substantially thick.

More than 100 target analytes are identified for the soil waste sites. The complete list of target analytes is provided in Chapter 4 and in the SAP (DOE/RL-2009-43).

The CSM for waste sites incorporates the following:

- *High-adsorption (distribution) coefficient (Kd) contaminants*: The highest soil contaminant concentrations are expected within and near the point of release. Sufficiently high volumes of liquids discharged into a waste site can increase the vertical extent of contamination in the vadose zone. Where little or no liquid effluents were discharged to a waste site, soil contamination is expected to remain within and only slightly below the point of release.
- *Low-absorption (distribution) coefficient (Kd) contaminants*: The highest levels of soil contamination are expected to be found near the point of release, but may also continue at elevated levels through the vadose zone to groundwater, depending on the discharge volume and infiltration rate. Soil contaminant levels generally decrease with depth, but contamination can be found at higher levels in lenses of fine materials. Limited data are available to evaluate vertical contaminant distribution behavior for several contaminants including nitrate, tritium, and Cr(VI).

Contaminated soil has been completely removed at waste sites to the depth of remedial action, significantly reducing contaminant inventories. The maximum depth of remedial action is 7.6 m (25 ft), while the typical depth of remedial action is generally 4.6 m (15 ft) or less. However, not all waste sites in 100-F/IU-2/IU-6 have been remediated.

Field data (described in Section 3.2.3) indicate that contaminant distributions at high-volume liquid waste sites for contaminants (e.g., arsenic, total chromium, mercury, Cr(VI), lead, Cs-137, Co-60, Eu-152, Ni-63, Pu-239/240, U-238, and U-233/234) are highest at the bottom of the disposal facility and, below that, generally decrease with depth. Soil samples collected and analyzed during interim remedial actions indicate that residual contamination is located well above the water table and the periodically re-wetted zone. Appendix B provides waste site locations and descriptions.

The inventory of contaminants remaining in the soil column has been significantly reduced by interim remedial actions (see Section 3.2.3). Contaminated soil removal, and subsequent disposal at the ERDF for the remaining source sites will continue. Data collected from these remaining source sites will provide information to assess the potential for adverse impacts through direct exposure or transport to groundwater pathways from remaining residual contamination.

Waste sites that received enough liquid effluent to impact groundwater have contamination at varying concentrations distributed sporadically throughout most of the vadose zone. Contaminants with low contaminant distribution coefficients (near zero) migrated through the vadose zone and into the groundwater when the waste sites were operational. Analytical data are needed to assess the vertical extent of contamination beyond the depth of the interim remedial actions that have been implemented at these waste sites. Leach tests and/or verification sampling from soil collected at the bottom of the remediated waste sites, combined with modeling, suggest that the residual contaminant concentrations are protective of groundwater and the Columbia River.

Many facilities within 100-F/IU-2/IU-6 have undergone D4, and the reactor building has been placed in ISS. Waste sites that are identified as part of the facility removal process are remediated using remedial action under interim action RODs. This process has resulted in limited characterization of soil beneath reactor structures. Because contaminants passed through reactor structures or were produced in reactor structures as part of operations, contaminants may be present beneath the structures at concentrations that pose risks to human health and/or ecological receptors.

3.5.2 Distribution of Contaminants in Groundwater

Hydrologic processes have influenced contaminant distribution in the subsurface as well as groundwater flow. Processes affecting contaminant migration continue (e.g., changing river stage). The effects of local anthropogenic alterations to groundwater flow have diminished over time with the cessation of reactor operations (e.g., no more coolant disposal).

Groundwater flow and elevations within 100-F and 100-IU2/IU-6 are influenced by fluctuating river stage. These changes are largely controlled by operation of the upstream Priest River Dam. During the spring, the river surface rises as dam flows increase with snow melt. The surface water rise displaces groundwater inland and raises the water table near the river. During this time, the hydraulic gradient is altered and less groundwater flows into the river. Conversely during the fall, the river surface declines and groundwater flow toward the river dominates once again. (Groundwater-surface water interactions are discussed further in Section 3.8.7.)

In 100-F, the primary anthropogenic influences on groundwater flow patterns when the reactor was operating were chronic unintentional losses of fluids from retention basins and intentional discharges to cribs and trenches. The effect of these long-term discharges was to create groundwater mounds under the discharge facilities. The large volume of liquid discharged was sufficient to create groundwater mounds 3 m (10 ft) or more above the nominal water table directly under the retention basins and other liquid-waste disposal facilities at 100-F (UNI-946). Some groundwater contamination may have been directed inland because of the influence of the mounds, only to resume moving toward the river, once liquid waste discharges terminated.

A remnant north-south trending Columbia River paleo-channel was identified in the eastern half of the area. Contaminants that migrated to the area during groundwater mounding could have subsequently preferentially migrated within the paleo-channel to the south. Once discharges in 100-F ceased, the groundwater mound dissipated into the Hanford formation. Current conditions show essentially no remnant effects on groundwater flow resulting from the previous groundwater mounding in the area.

In the area north of 200 East, a traceable paleo-channel extends through Gable Gap across the eastern part of 200 East and to the southeast (Figure 2-3). This channel influences contaminant transport distribution in the unconfined aquifer (e.g., the Sitewide tritium plume).

3.6 Human Receptors and Exposure Pathways

The EPA risk assessment guidance describes an exposure pathway as being the course that a contaminant takes from a source to a receptor (EPA/540/1-89/002, *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A, Interim Final*). Exposure pathways integrate information relating to sources and/or releases of contamination, contaminant transport pathways in the environment, exposure media, and exposure routes for receptors. Exposure pathways must contain all of the following elements; otherwise, the pathway is not complete and does not present a risk or hazard (EPA/540/1-89/002; EPA/540/1-89/001, *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual, Interim Final*).

- Known and potential sources and/or releases of contamination
- Contaminant migration pathways
- Potential exposure scenarios
- Potential exposure media
- Potential exposure routes
- Receptors

Known and potential sources and/or releases of contamination include shallow vadose zone soil, deep vadose zone soil, sediment, and groundwater. Migration of contaminants from one source medium may affect other media such as biota, air, groundwater, and surface water.

3.7 Ecological Receptors and Exposure Pathways

DOE/RL-2004-37, *Risk Assessment Work Plan for the 100 Area and 300 Area Component of the RCBRA* identifies and describes the ecological receptors and exposure pathways for the 100 Areas. A remaining ecological exposure pathway uncertainty for 100-F/IU-2/IU-6 involves the discharge of contaminated groundwater to ecological receptors within the Columbia River.

3.8 Conceptual Site Model Summary

The following discussion postulates the evolution of Cr(VI), nitrate, Sr-90, and TCE distribution in the subsurface with emphasis on hydrogeologic system characteristics and processes controlling contaminant distribution.

3.8.1 Conceptual Site Model for Hexavalent Chromium

The great majority of Cr(VI) was discharged into the surrounding environment as a dissolved species in various liquids. Historical records show that Cr(VI) was released into the environment primarily as a dissolved species in two types of solutions: stock solutions used to make reactor coolant and reactor coolant itself.

In the CSM initially developed for the 100-FR-3 OU, an estimated 28,000 m^3/day (1 million ft^3/day) had leaked into the soil column during operations at 116-F-14. Sodium dichromate that was used to treat the cooling water dissociated to create a Cr(VI) concentration ranging between 700 to 800 μg/L. At the above leakage volume and using the lower 700 μg/L concentration, approximately 20 kg (44 lb) per day of Cr(VI) was released to the soil column (BHI-00917, *Conceptual Site Models for Groundwater Contamination at the 100-BC-5, 100-KR-4, 100-HR-3, and 100-FR-3 Operable Units*). This value represents a conventionally accepted order of magnitude estimate. Table 2-3 provides annual and total sodium dichromate mass estimates.

The total amount of Cr(VI) used during production is estimated to be 1.6 million kgs (3.5 million lbs); however, this quantity includes both the mass discharged to the river as well as mass remaining in the soil and groundwater. Cr(VI) was likely pushed inland by the growing groundwater mound. Data from Well 699-77-36 suggest that the hydraulic effects from the mound extended approximately 2 km (1 mi) inland. The highly soluble Cr(VI) could have been present throughout the impacted area at concentration levels less than 700 μg/L (i.e., concentration in coolant). No chromium data are available from Well 699-77-36 for the period when the groundwater mound was present. The well was first sampled for chromium in 1987, and chromium was undetected.

Based on reactor operations and liquid discharge history, it is estimated that a large portion of the chromium mass discharged to the river. As early as September 1945, effluent springs began to appear along the riverbank in association with retention basin leakage. At least 30 springs were identified along the 100-F shoreline extending north and south of the spillway approximately 244 and 457 m (800 and 1,500 ft), respectively, as identified in leaks in the 107-F and 107-D Basins (HW-3-3259, *Leaks in 107-F and 107-D Basin*). The highest observed Cr(VI) concentrations were reported in samples collected in the immediate vicinity of the spillway. An examination of the riverbank in 1984 found only two springs remaining, at the river water intake and the eastern boundary of 100-F.

The rapid formation of the groundwater mound shortly after discharges began suggests that Cr(VI), and other mobile contaminants, migrated quickly through the vadose zone and penetrated into the unconfined aquifer. After operations ceased and there was no longer large-scale infiltration from the effluent discharges, the groundwater mound dissipated. By the mid-1970s, the natural groundwater gradient was essentially reestablished, with the seasonal impacts of high and low river stage controlling groundwater elevations and flow. Evaluation of chromium (total/hexavalent) concentrations in monitoring wells from 1993 (DOE/RL-93-83) to 2008 (DOE/RL-2008-66) indicates that they have diminished considerably over that interval, in some cases, by nearly an order of magnitude (e.g., at 199-F8-4).

Unlike the Cr(VI) contamination observed from processes at 100-D, apparently only relatively low concentration Cr(VI) waste was discharged to the subsurface at 100-F because of the production facility setup. There was a much longer period of using dry dichromate powder to mix corrosion control solutions for 105-F Reactor water treatment as compared to other 100 Area reactors; and the installation of newer equipment during the plant upgrades diminished the opportunity for leaks of the concentrated 70 percent solution. However, delivery of the 70 percent solution into the storage tanks at 185/190-F, waste site 100-F-57 (DUN-1818, *Discharge of Sodium Dichromate Solution Compliance with Executive Order 11258*) was not completely efficient, and yellowish-stained soil around the storage tank location indicates some losses. The fraction of delivered 70 percent solution lost to the subsurface is not known. However, the current concentrations observed in groundwater do not indicate the presence of a highly concentrated, persistent source.

3.8.2 Conceptual Site Model for Nitrate

The EAF, formerly located in the northeast portion of 100-F, near the 116-F-9 Trench and 116-F-2 Trench, was used to test the effects of radioactivity and radiological contamination on living organisms including both plants and animals. Nitrate is a common component of animal urine and feces. An additional source of nitrate in 100-F/100-IU-2/IU-6 is from pre-Hanford agricultural use.

A portion of the nitrate that reached groundwater near the animal pens was transported inland due to the groundwater mounding caused by reactor operations. Preferential migration along the previously described paleo-channel may account for the current configuration of the nitrate plume within the southern portion of 100-F within 100-F/100-IU-2/IU-6 (see Figure 3-9).

3.8.3 Conceptual Site Model for Strontium-90

Facilities producing biological waste materials contaminated with Sr-90 included the EAF and radioecology laboratory. The main facilities used to house the animals were 141-F and 141-C. Animal pens in both buildings had concrete floors and were connected to a special sewer system for contaminated animal wastes. Two smaller buildings, 141-P and 141-S, were also used for housing animals. These buildings had dirt floors, potentially allowing migration of contaminants to the vadose zone. Feed was stored in 141-B, and the laboratory facilities were housed in 141-H. The animal monitoring laboratory housing a whole body counter was in building 145-F (DOE/RL-93-83). Building 108-F was used as the main laboratory facility. This facility, and others that were re-purposed once the reactor was shut down, had dedicated disposal sites for contaminated animal/plant experiment wastes.

The EAF was located within the current footprint of the Sr-90 plume within 100-F. The most likely explanation for the continued elevated presence of Sr-90 in groundwater within the 100-F Area is that it came from releases from its use in biological experiments at the EAF and discharges to the 116-F-9 Trench. The disposal of contaminated urine and manure directly to the ground (via animal pens with dirt floors), coupled with the moderate solubility of Sr-90, most likely contributed to some accumulation in the vadose zone.

The actual quantity of Sr-90 that was discharged to the subsurface from these animal wastes, decontamination solutions, and contaminated reactor coolant or FSB liquid is uncertain. However, there appears to be enough inventory for local groundwater concentrations to persistently exceed the drinking water standard. Strontium-90, being less mobile than Cr(VI), did not migrate as far during the mounding process and has not dispersed as much since the end of reactor operations and dissipation of groundwater mounds.

Strontium-90 was also present in solid waste disposed at various burial grounds. The 118-F-1 and 118-F-6 solid waste burial grounds are located southwest of the 105-F Reactor. These are also possible sources of current aquifer contamination, although these locations are much less likely to be significant compared to liquid discharge sites. Strontium-90 was detected at concentrations above the drinking water standards in groundwater samples collected during the excavation of 118-F-6. Continued slow dispersion and migration of Sr-90 is expected from any remaining source areas due to its moderate solubility and mobility.

3.8.4 Conceptual Site Model for Trichloroethene

In 1993, the LFI conducted for 100-FR-3 identified TCE as a COPC (DOE/RL-93-83). In groundwater samples collected in 1994, TCE was detected at concentrations exceeding the state and federal drinking water standards of 5μg/L. A supplemental LFI (DOE/RL-95-99) was conducted to determine the extent and potential sources of TCE in groundwater. The highest detected groundwater concentration was 52 μg/L.

The source of the TCE groundwater plume has not been identified. However, concentrations within the plume have been decreasing (Figure 3-13); therefore, a concentrated residual source of TCE is not suspected. Thus, no interim remedial measures were recommended (or implemented) because of the supplemental LFI.

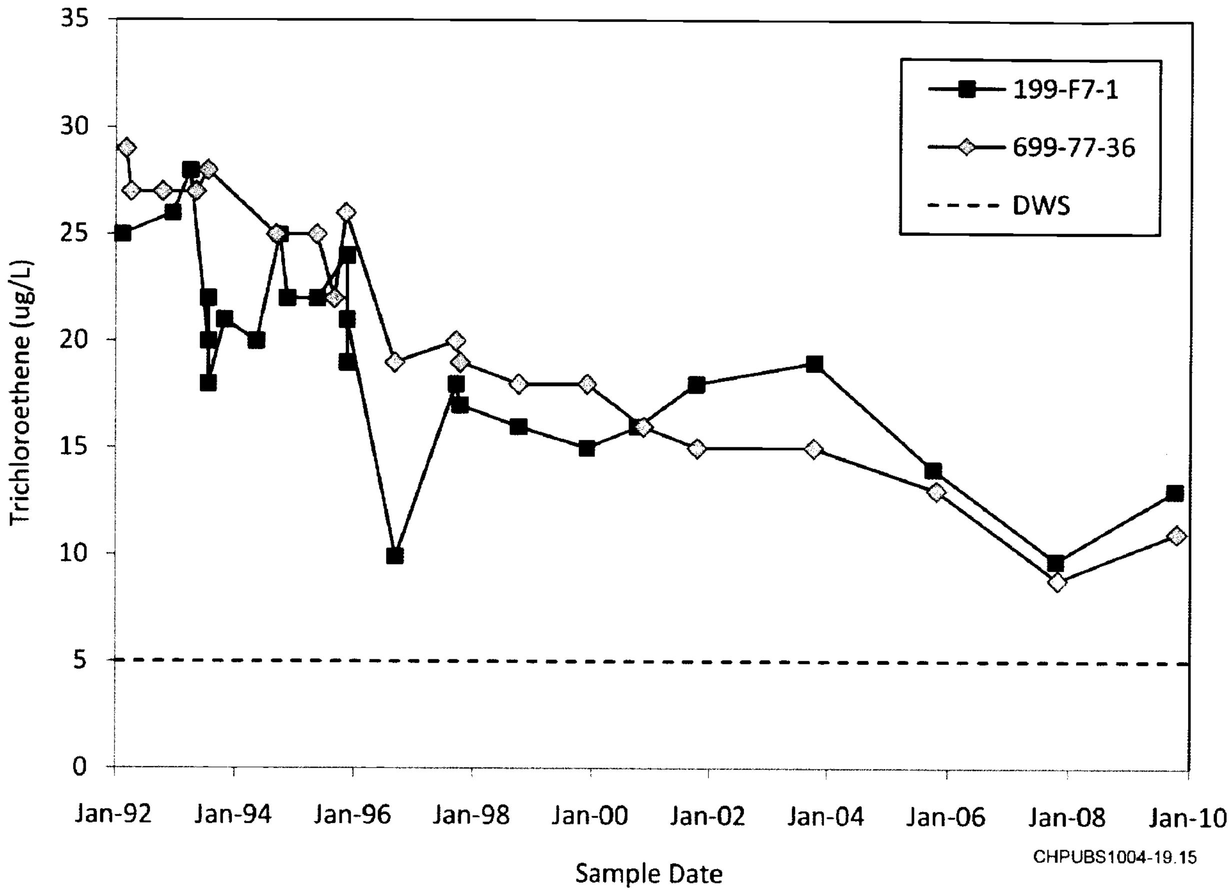


Figure 3-13. Trichloroethene Trends in Groundwater in Southwestern 100-F

3.8.5 Conceptual Site Model for Low-Mobility Contaminants

Low-mobility contaminants (those with high K_d) are expected to be found at the greatest concentrations within and near the areas of discharge. When little or no liquid effluent was discharged to a waste site, soil contamination is expected to remain in the shallow sediment. Most of this shallow contamination has been removed during remediation activities. Sufficiently high volumes of liquids discharged into a waste site can modestly expand the depth of contamination in the vadose zone.

If sufficient mass of the contaminant is discharged, the soil's capacity to sorb the contaminant may be overwhelmed, causing the contaminant to spread. In addition, competing similar ionic substances may cause the contaminant to temporarily desorb and spread. These conditions have been observed in the central plateau where high-concentration brine solutions have resulted in enhanced transport of contaminants. Liquids discharged in the 100 Area waste sites did not have similar chemical attributes. Groundwater samples currently are not routinely analyzed for low-mobility radionuclides (e.g., Cs-137, Co-60, Pu-238, Pu-239) or low-mobility metals (e.g., lead, mercury). Groundwater data from the early 1990s, collected for a Limited Field Investigation (DOE/RL-93-83; see Section 3.3.1) had few detections of these contaminants, supporting the interpretation that they did not migrate to groundwater in significant quantities.

3.8.6 Ringold Upper Mud and Lower Hydrogeologic Units

The RUM Unit, which underlies the unconfined aquifer, has been described as primarily clayey silt and silty clay, with lenses of silty sand and sandy silt. Only one well (199-F5-43B) in 100-F has been completed in the RUM (or hydrogeologic units beneath it). Well 199-F5-43B is located downgradient of the 116-F-9 Trench, and relatively close to the Columbia River shoreline (see 100-F Base Map in Appendix A). Groundwater samples from this well were analyzed for constituents that include organics, inorganics, and radionuclides. Since sampling was initiated in 1995, groundwater contaminants have not been detected at concentrations above cleanup standards.

Based on current knowledge of the RUM's elevation from inland wells, as well as the river bathymetry, the top of the RUM intersects the river channel, toward the bottom of the channel in 100-F.

3.8.7 Groundwater/River Interactions

Intermingling of groundwater and river water in the zone of interaction and locations of groundwater discharges into the river channel are key issues in understanding the rates and magnitudes of contaminants migrating to the Columbia River. The working hypothesis is that mixing between groundwater and, at times, infiltrating river water may cause dilution of contaminant concentrations in groundwater up to considerable depths within the aquifer.

Groundwater discharge into the river environment may occur across the riparian zone as seeps and within the river channel substrate. Riverbank seepage creates a potential human health risk through direct exposure to contaminants and through introduction of contaminants into the food chain. Upwelling of groundwater into the channel substrate poses a potential risk to aquatic organisms.

Groundwater flow near the river is strongly influenced by river stage (which is directly controlled by the upstream Priest Rapids Dam). This rise and fall of river stage creates a dynamic zone of interaction between the groundwater and river water, and influences flow patterns, transport rates, contaminant concentrations, and attenuation rates within the system (PNNL-13674). The water table in the aquifer responds to changing river stage up to several hundred meters inland, including areas where the highest Cr(VI) concentrations have been detected in 100-F. Columbia River elevations have varied by as much as 2.7 m (9 ft) in a single day. Groundwater elevations have varied by up to 0.9 m (3 ft) in 1 day in some wells nearest the river and up to approximately 1.8 m (6 ft) seasonally in a few wells (PNL-9437, *Monitoring Groundwater and River Interaction Along the Hanford Reach of the Columbia River*).

Riverbank seep discharges to the river are visible during low river stage. Conversely, during high river stages, the seeps are submerged as river water infiltrates into the riverbanks and forms either a layered system or a mixture during interaction with approaching groundwater. Data indicate that the composition of riverbank storage water oscillates dramatically from nearly completely river water during high river stage to primarily groundwater during low river stage (PNNL-13674). Figure 3-14 illustrates this phenomenon.

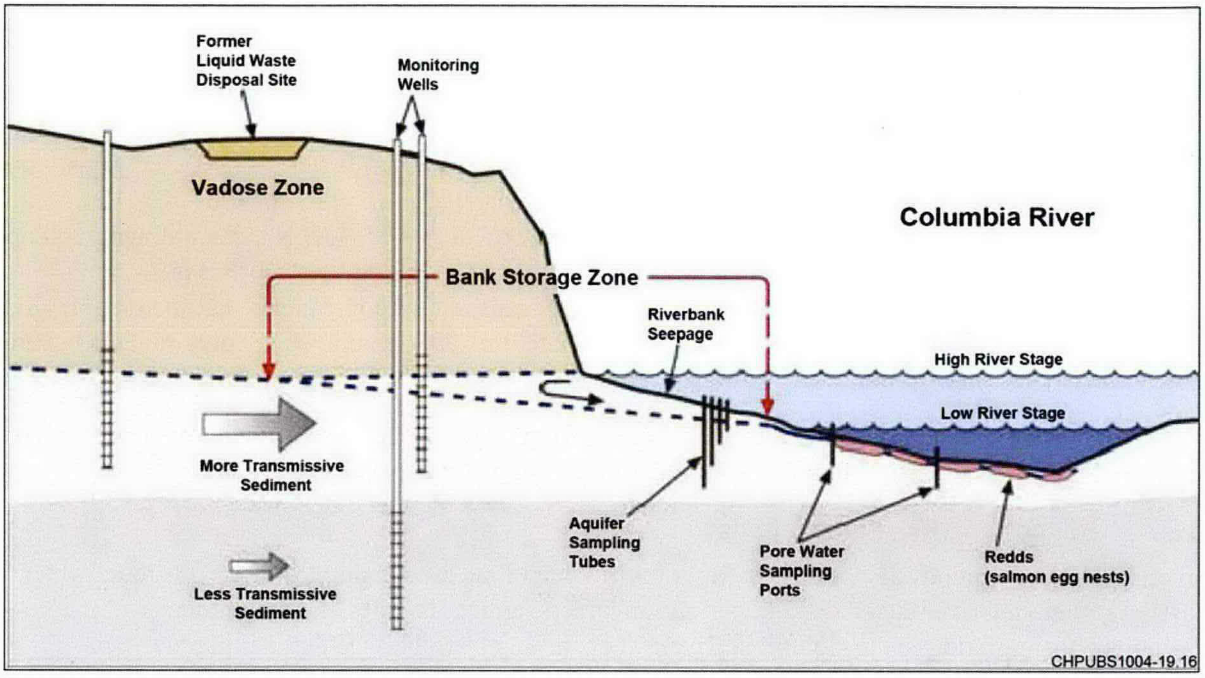


Figure 3-14. Illustration of Riverbank Seepage
Source: *PNNL-13674, Zone of Interaction Between Hanford Site Groundwater and Adjacent Columbia River: Progress Report for the Groundwater/River Interface Task Science and Technology Groundwater/Vadose Zone Integration Project*

In the channel substrate, sediment pore water may be influenced by the entrainment of river water and the gradual influx of groundwater that upwells from the underlying aquifer. Physical, chemical, and biological characteristics of this interface have been the focus of research in aquatic biology (i.e., Geist and Dauble, 1998, "Redd Site Selection and Spawning Habitat Use by Fall Chinook Salmon: The Importance of Geomorphic Features in Large Rivers"; Geist, 2000, "The Interaction of Ground Water and Surface water within Fall Chinook Salmon Spawning Areas in the Hanford Reach of the Columbia River"). Upwelling of groundwater from 100-F may directly impact salmon spawning areas (shown in Figure 3-15). However, preliminary data from a pore water sampling study in 2009 showed that Cr(VI) was undetected in all but one sample. The sole detection was below the 10 μg/L aquatic standard.

Physical, chemical, and biological processes that potentially alter the characteristics of approaching groundwater occur within the zone of interaction. Data suggest that physical processes dominate influences on contaminant concentrations and fluxes where groundwater discharges into the free-flowing river. Chemical processes may render contaminants less mobile as they adsorb to sediment or precipitate. Zone of interaction biological activity may also capture contaminants and immobilize them, or introduce them into the food chain (PNNL-13674).

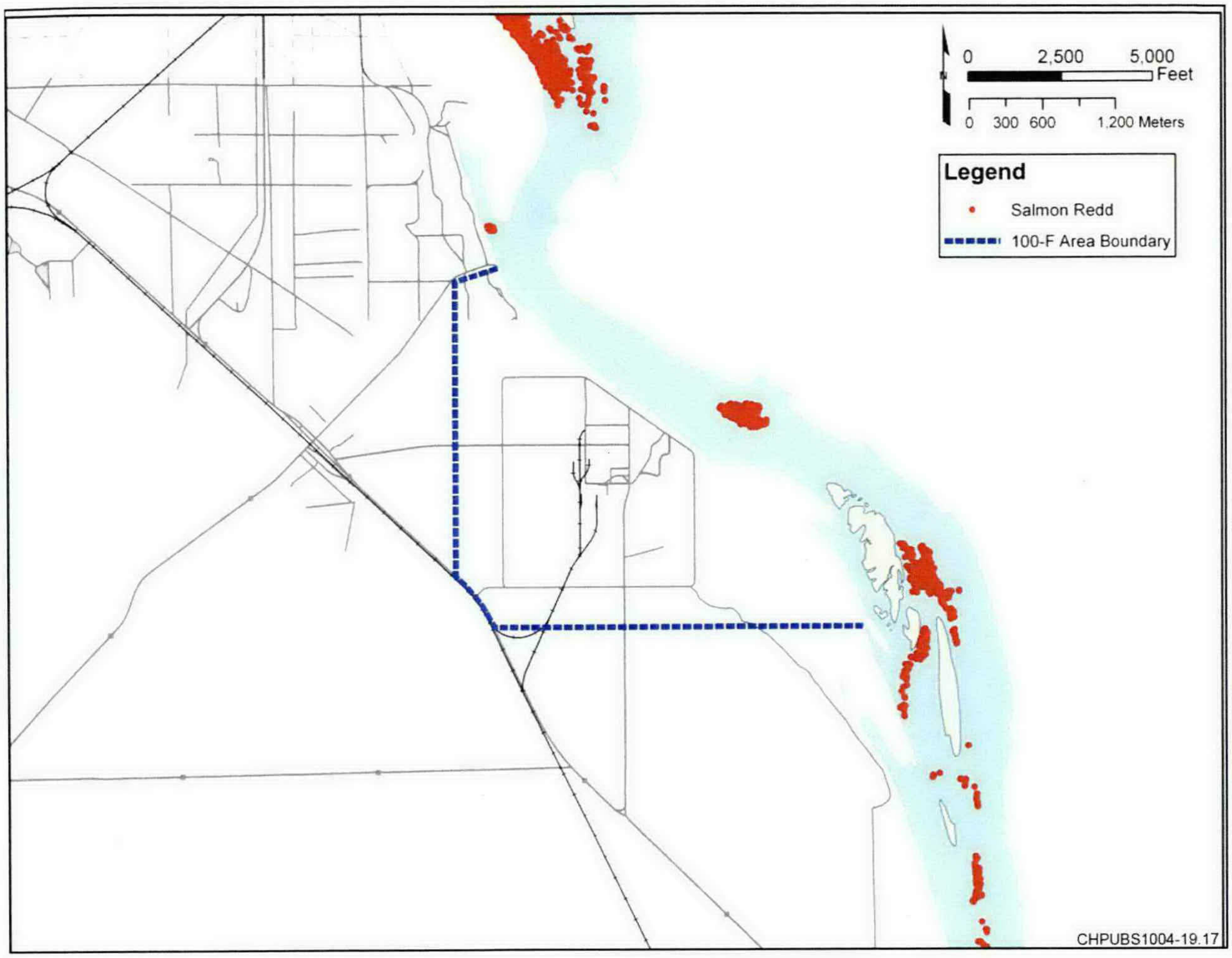


Figure 3-15. Salmon Redds Adjacent to 100-F/I U-2/IU-6

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4 Work Plan Rationale and Tasks

This section identifies the process for target analyte and COPC development, data gaps, and tasks to address uncertainties needed to refine the CSM and support decision making. Information is needed to fill these data gaps before decisions can be made regarding the remediation of the vadose zone and groundwater. Data gaps in this section address uncertainties associated with the nature and extent of contamination, fate and transport, and the hydrogeologic framework.

4.1 Approach

The Integrated Work Plan (DOE/RL-2008-46) includes preliminary RAOs for the 100 Area (Table 4-1). The RAOs are refined through the RI/FS process during the RI, River Corridor Baseline Risk Assessment (RCBRA), and the detailed analyses of alternatives conducted in the FS; final RAOs are determined when the remedy is selected in the ROD. The preliminary RAOs include media-specific objectives for groundwater, surface water, soil, land use, and natural/ cultural resources. The RAOs will be used to drive the remediation selection for 100-F/IU-2/IU-6.

Table 4-1. Preliminary Remedial Action Objectives for the 100 Area Operable Units

RAO No.	Goal
	Groundwater
1	Prevent unacceptable risk to human health from ingestion of and incidental exposure to groundwater containing nonradiological contaminant concentrations above federal and state standards.
2	Prevent unacceptable risk to human health from ingestion of and incidental exposure to groundwater containing radiological contaminant concentrations above federal standards.
	Surface Water
3	Prevent unacceptable risk to human health and ecological exposure to surface water containing nonradiological contaminant concentrations above federal and state standards.
4	Prevent unacceptable risk to human health and ecological exposure to surface water containing radiological contaminant concentrations above federal standards.
	Soil
5	Prevent hazardous chemical contaminants from migrating and/or leaching through soil that will result in groundwater concentrations that exceed standards for protection of surface and groundwater.
6	Prevent migration and/or leaching of radioactive contaminants through soil to groundwater in excess of federal standards.
7	Prevent unacceptable risk to human health and ecological receptors from exposure to the upper 4.6 m (15 ft) of soil contaminated with nonradiological constituents at concentrations above the unrestricted land use criteria for human health or soil contaminant levels for ecological receptors.
8	Prevent unacceptable risk to human health and ecological receptors from exposure to upper 4.6 m (15 ft) of soil and to structures and debris contaminated with radiological constituents. Prevent exposure to radiological constituents at concentrations at or above a dose rate limit that causes an excess cancer lifetime risk threshold of 10^{-6} to 10^{-4} above background for the rural residential exposure scenario. An annual dose rate limit of 15 mrem/yr above background achieves EPA excess lifetime cancer risk threshold.
	Protect ecological receptors based on a dose rate limit of 0.1 rad/day for terrestrial wildlife populations, which is a "to-be-considered" criterion.

Table 4-1. Preliminary Remedial Action Objectives for the 100 Area Operable Units

RAO No.	Goal
	Land Use and Resource
9	Prevent adverse impacts to cultural resources, threatened or endangered wildlife, and ecological receptors using the Columbia River and prevent destruction of sensitive wildlife habitat.
10	Where it is not practicable to remediate levels that will allow for unrestricted use, ensure that appropriate institutional controls and monitoring requirements are established and maintained to protect future users of the remediated waste sites.

EPA = U.S. Environmental Protection Agency

The preliminary remediation goals (PRGs) provide target cleanup levels for use in evaluating RAO achievement. They also provide preliminary risk reduction targets that a remedial alternative must meet to achieve the criteria set forth in 40 CFR 300.430(e)(9)(iii), "National Oil and Hazardous Substances Pollution Contingency Plan," "Remedial Investigation/Feasibility Study and Selection of Remedy," "Feasibility Study." As additional information becomes available from site-specific risk information, RI site characterization, and chemical-specific applicable or relevant and appropriate requirement (ARARs), the PRGs will be developed and finalized in the RI/FS Report.

4.2 Development of Vadose Zone Soil Target Analyte Lists and Groundwater Contaminants of Potential Concern

A process has been developed to identify vadose zone soil target analytes for addressing uncertainties associated with the nature and extent of contamination in the vadose zone. Similarly, a process has been developed to identify groundwater COPCs for addressing uncertainties associated with the spatial and temporal distribution of groundwater contamination. This section summarizes that process, and provides tables of analytes for 100-F/IU-2/IU-6. The Integrated Work Plan (DOE/RL-2008-46) provides additional detail on the process.

4.2.1 Vadose Zone Soil Target Analyte List

Remediation and characterization information was reviewed to develop an initial list of target analytes to represent potential contamination in the vadose zone. Information sources included focused feasibility studies, LFI reports, CVPs, RSVPs, interim action ROD, technical baseline reports, and databases containing analytical data resulting from these activities.

After the initial target analyte list was compiled (Appendix D), the information underwent additional review steps to remove analytes, using generally accepted exclusion criteria (e.g., naturally occurring radionuclides; radionuclides with short half-lives; essential nutrients; and analytes with no toxicity values). The soil target analyte list was compared to the groundwater COPC list, and groundwater COPCs not found on the soil list were added to it to create the master soil target analyte list.

Next, appropriate analytical methods were determined for each analyte on the master list. Detection limits for each target analyte were evaluated to determine whether they could achieve the remedial action goals for direct exposure, groundwater protection, and Columbia River protection. Table 4-2 is the master target analyte list for the 100-F. There are no target analytes for soil in 100-IU-2/IU-6 since no soil characterization is being conducted in this area as part of this work plan.

Table 4-2. Master Soil Target Analyte List for 100-F

Radionuclides	Nonradionuclides			
Cesium-137	Fluoride	Mercury	Chlorobenzene	Fluoranthene
Cobalt-60	Nitrate	Aroclor-1016 (PCB)	Chloroform	Naphthalene
Europium-152	Chromium (hexavalent)	Aroclor-1221(PCB)	Ethylbenzene	Phenanthrene
Europium-154	Antimony	Aroclor-1232(PCB)	Methylene chloride	Pyrene
Europium-155	Arsenic	Aroclor-1242(PCB)	Styrene	Dalapon
Americium-241	Barium	Aroclor-1248(PCB)	Tetrachloroethene	BHC-Alpha
Barium-133	Beryllium	Aroclor-1254 (PCB)	Trichloroethene	Heptachlor epoxide
Silver-108m	Boron	Aroclor-1260 (PCB)	Toluene	4,4'-DDD
Strontium-90	Cadmium	2-methylnapthalene	Vinyl Chloride	4,4-DDE
Plutonium-238	Chromium (total)	Carbazole	Xylene	4,4-DDT
Plutonium-239/240	Cobalt	Dibenzofuran	Benzo(a)pyrene	Aldrin
Uranium-233/234	Copper	Phthalate (butyl benzyl)	Chrysene	Chlordane (alpha, gamma)
Uranium-235	Lead	Phthalate (bis 2-ethylhexyl)	Fluorene	BHC-beta
Uranium-238	Manganese	Phthalate (di-ethyl)	Indeno(1,2,3-cd)pyrene	Endosulfan I
Carbon-14	Molybdenum	Phthalate (di-methyl)	Acenaphthene	Endosulfan sulfate
Nickel-63	Nickel	Phthalate (di-n-butyl)	Anthracene	Endrin aldehyde
Technetium-99	Selenium	Phenol	Benzo(a)anthracene	Endrin ketone
Tritium	Silver	1,1-Dichloroethene	Benzo(b) fluoranthene	Methoxychlor
	Thallium	2-butanone	Benzo(g,h,i)perylene	Toxaphene
	Vanadium	2-hexanone	Benzo(k) fluoranthene	TPH–Diesel
	Zinc	4-methyl-2-pentanone	Dibenz(a,h)anthracene	
		Acetone		
		Carbon Tetrachloride		

Note:

4,4'-DDD	=	4,4'- Dichlorodiphenyldichloroethane
4,4-DDE	=	4,4- Dichlorodiphenyldichloroethylene
4,4-DDT	=	4,4- Dichlorodiphenyltrichloroethane
alpha- BHC	=	alpha-1,2,3,4,5,6-hexachlorocylohexane
PCB	=	polychlorinated biphenyls
TPH-Diesel	=	Total Petroleum Hydrocarbon-Diesel

The master target analyte list represents all potential target analytes that could be present in the vadose zone. Location specific target analytes were identified from the master list using the following approach.

- Identify the contaminants of concern (COC) for the specific waste sites from the interim action ROD (EPA/ROD/R10-99/039) (which reflects information from LFIs and technical baseline reports) or from verification documentation, such as a CVPs or RSVPs. Include these analytes on the location specific target analyte list.
- Evaluate local groundwater data (wells located within waste site "zones of influence"). If the groundwater COPCs have been analyzed for but not detected, these analytes will not be included on the location specific target analyte list. If the groundwater COPCs have been analyzed for and have been detected, these analytes will be included on the location specific soil target analyte list. If the groundwater COPCs have not been analyzed for, an additional evaluation will be performed to determine if analyses for these COPCs is needed. If so, these COPCs will be included on the waste site-specific soil target analyte list.

Regulatory agency review of the target analyte lists allows for the adjustment/addition of sample locations and target analytes on a site-specific basis. This adjustment has been agreed upon to ensure that regulator concerns regarding data gaps and uncertainties are addressed. When additional information needs are identified, the agencies will modify the characterization locations required and may adjust the location specific target analyte lists.

Location specific target analyte lists are provided in Section 2 of the SAP (DOE/RL-2009-43).

4.2.2 Groundwater Contaminants of Potential Concern

This process identified groundwater COPCs that will be carried forward and evaluated for nature and extent characterization and to address RCBRA groundwater risk uncertainties. A COPC is a constituent identified as a potential threat to human health or the environment with data of sufficient quality for use in a baseline QRA. Action levels were derived from readily available chemical-specific ARARs, such as Maximum Contaminant Levels, Ambient Water Quality Criteria, or risk-based PRGs using EPA health criteria and default exposure assumptions.

A groundwater data set was prepared for 100-F/IU-2/IU-6 to identify groundwater COPCs, as shown in Appendix D. Analytical data were obtained from the Hanford Environmental Information System database for all wells identified within the area. The analytical data set represents groundwater samples collected between 1992 and 2008. This timeframe was selected because it captures analytical data collected during the LFI, which were used to prepare the QRA. In the early 1990s, groundwater samples were analyzed for a comprehensive set of constituents. Because many of the analytes were undetected, selected constituents were dropped from routine groundwater monitoring. Thus, some of the groundwater COPCs have only a short period of record. Results from unfiltered samples were selected, as these data represent total concentrations of the analyte. Use of filtered sampling results may underestimate chemical and radiological concentrations and are not used for the COPC selection process.

After the initial COPC list was compiled, the information underwent additional review steps to remove analytes, using generally accepted exclusion criteria (e.g., naturally occurring radionuclides; radionuclides with short half-lives; essential nutrients; water quality parameters that do not have available toxicological information; and analytes without an action level). Analytes that were not detected in any of the groundwater samples were eliminated as groundwater COPCs. Analytical results that were rejected and flagged with an "R" qualifier were not considered reliable and were thus not included as a detection for that analyte. All constituents that were detected at least once were carried to the next step.

Analytes whose maximum concentrations are less than their action levels were not identified as COPCs. Steps were taken to identify when an analyte was detected infrequently to determine if the results are reproducible or associated with localized contamination. Additionally, method detection limits were evaluated to determine if they are adequate for determining presence or absence at the action level. If the results of this comparison showed that the presence of an analyte was reproducible, then the analyte was identified as a groundwater COPC.

Next, groundwater COPCs were compared to the master target analyte list for soil. This step of the process is used to confirm that the target analytes identified for vadose zone soil are appropriately considered for groundwater. Based on the transport mechanisms associated with the target analytes, it is a reasonable assumption that not all target analytes identified for vadose zone soil will be COPCs for groundwater. For example, contaminants that are relatively immobile in water, such as PCBs, are not included as groundwater COPCs.

Tables 4-3 and 4-4 list the resulting groundwater COPCs for 100-F/IU-2/IU-6. Regulatory agencies review the groundwater COPC list and may modify the list, as they do for soil target analyte lists.

Table 4-3. 100-F Area Groundwater Contaminants of Potential Concern

Radionuclides	Nonradionuclides		
Americium-241	Antimony	Manganese	Chloroform
Carbon-14	Arsenic	Mercury	Styrene
Cesium-137	Beryllium	Nickel	Tetrachloroethene
Cobalt-60	Cadmium	Selenium	Trichloroethene
Europium-154	Chromium	Thallium	Vinyl Chloride
Iodine-129	Cobalt	Zinc	Fluoride
Plutonium-238	Copper	1,1-Dichloroethene	Nitrate
Plutonium-239/240	Hexavalent Chromium	Carbon Tetrachloride	Sulfate
Strontium-90	Lead		
Technetium-99			
Thorium-230			
Tritium			

Table 4-4. 100-IU-2/IU-6 Area Groundwater Contaminants of Potential Concern

Radionuclides	Nonradionuclides		
Americium-241	Antimony	Mercury	Chloroform
Carbon-14	Arsenic	Nickel	Trichloroethene
Cesium-137	Cadmium	Thallium	Tetrachloroethene
Cobalt-60	Cobalt	Zinc	Vinyl Chloride
Europium-152	Copper	1,1-Dichloroethene	Fluoride
Europium-154	Hexavalent Chromium	Benzene	Nitrate
Europium-155	Lead	Carbon Tetrachloride	Total petroleum hydrocarbon – diesel range
Iodine-129	Manganese		
Strontium-90			
Radium-228			
Technetium-99			
Tritium			

4.3 Identification of Data Gaps

A product of the planning process is the identification of data gaps. Systematic planning identified eight data gaps to address uncertainties within the study area. The identified data gaps were selected to address uncertainties associated with the nature and extent of contamination, fate and transport, and the hydrogeologic setting. Data gaps are identified in Table 4-5, including a description of data needs, planned efforts (i.e., drilling, sampling, and analysis) to address each uncertainty, and relevant background information. Additional background information and the rationale for planned efforts are presented in Sections 4.3.1 and 4.3.2. Section 4.3.3 presents additional tasks above and beyond those needed to address specific data gaps. Table 4-6 summarizes the number of boreholes and wells to be drilled and sampled. Figure 4-1 shows the locations of boreholes, wells, and waste sites in 100-F that are described in this section, while Figure 4-2 shows the locations of wells to be sampled in 100-F/IU-2/IU-6. Details of the sampling program, including the number of samples and analytical tests, are presented in the SAP (DOE/RL-2009-43).

Table 4-5. 100-F/IU-2/IU-6 Data Gaps

Data Gap	Data Gap No.	Data Need	Description	Additional Data Collection Recommended?	Scope of Work	Justification
Data are needed to refine the conceptual site model of contaminant distribution beneath un-remediated waste sites.	1	Assess the nature and vertical extent of contamination beneath un-remediated waste sites.	Continue interim remedial actions, as they have proven to be efficient in obtaining the necessary data during remediation. Obtain data documenting the remaining residual contamination following completion of the interim remedial actions.	Yes	Complete contaminated soil removal and sampling at 14 waste sites in the 100-F Area and 70 waste sites in the 100-IU-2 and IU-6 OUs. The unremediated waste sites are listed in Appendix B, and the SAP (DOE/RL-2009-43). A site-specific evaluation shall be performed on site 100-F-59 to determine if existing data are consistent with the current RCBRA.	Remediation is needed to protect human health and the environment. Data collected upon completion of remediation are needed to assess risk from direct exposure, protection of groundwater, and protection of the Columbia River. Data collected from 100-F-59 indicate that contaminant concentrations are above background concentrations. A site-specific evaluation is needed to support final remedy selection.
Data are needed to refine the conceptual site model of contaminant distribution beneath selected remediated waste sites.	2	Assess the nature and vertical extent of contamination beneath selected remediated waste sites.	Drill two boreholes and collect samples for analysis for target analytes to assess the vertical extent of contamination in the vadose zone at the borehole locations.	Yes	Drill one borehole each at the following waste sites: the 116-F-14 Retention Basin and the 118-F-1 Burial Ground. Collect and analyze soil samples for target analytes. Details are presented in the SAP (DOE/RL-2009-43).	Characterization is needed to validate interim remedial action, and address uncertainty regarding the nature and extent of residual contamination in the vadose zone.
Data are needed to refine the conceptual site model of contaminant distribution beneath and around reactor structures.	3	Assess the nature and vertical extent of contamination in the vadose zone around the 105-F Reactor structure.	Drill one borehole near the reactor structure in an area most likely to be contaminated and collect samples for analysis for target analytes to assess the vertical extent of contamination in the vadose zone.	Yes	A borehole in the boundary of the 118-F-8 Reactor FSB will be drilled and soil samples will be collected and analyzed to target analytes. Details are presented in the SAP (DOE/RL-2009-43).	The 118-F-8 Reactor Fuel Storage Basin was selected for additional characterization because of documented leaks at this location.
The nature and extent of contamination exceeding cleanup standards in the unconfined aquifer have not been defined in all areas, nor for all COPCs.	4	Identify groundwater contaminants and define the extent of contamination both horizontally and vertically.	Groundwater contamination has been detected at concentrations above water quality standards in the unconfined aquifer in the 100-F Area. The extent of contamination in the unconfined aquifer has not been fully defined horizontally or vertically.	Yes	Install two new groundwater monitoring wells (Figure 4-1). Well 1 will be installed to further define the extent of Cr(VI). Well 2 will be installed to further define the extent of Sr-90. Well 3 will be drilled into the RUM Unit and will define the vertical distribution of contaminants through the unconfined aquifer and within the RUM Unit. Groundwater samples will be collected at various depths and analyzed for COPCs, as specified in the SAP. Sample new and existing monitoring wells for all groundwater COPCs. Details are found in the SAP (DOE/RL-2009-43). Sampling will also be conducted to address data gap No. 8.	New wells are proposed to further define the extent of Cr(VI) and Sr-90 contamination. The extent of Cr(VI) contamination has not been sufficiently defined to the west of Well 199-F5-6. The extent of strontium-90 contamination has not been sufficiently defined to the south of the 116-F-14 Retention Basin.
Contaminant concentrations entering the Columbia River are not well known.	5	Data from the aquifer tube network are needed to monitor contaminant concentrations over time and with depth near the river.	Aquifer tubes have been installed to analyze groundwater contaminants discharging to the river. These aquifer tubes are typically analyzed for contaminants once a year.	Yes	Continue routine sampling of existing aquifer tubes per the *SAP for Aquifer Sampling Tubes* (DOE/RL-2000-59[a]).	Continued sampling is needed to define the nature and extent of groundwater contamination approaching and entering the river.
Contaminant fate and transport beneath the unconfined aquifer have not been evaluated sufficiently over 100-F/IU-2/IU-6.	6	Evaluate the integrity of the aquitard unit and contaminant fate and transport within the aquitard.	The RUM Unit is currently considered an aquitard. The integrity of the aquitard unit and potential contaminant transport within the aquitard have not been evaluated.	Yes	Collect split-spoon soil samples from 1.5 m (5 ft) into the RUM Unit during drilling for new wells 1 and 2, and 15 m (50 ft) into the RUM Unit during drilling for new well 3 (Figure 4-1). Screen well 3 within the first water-bearing zone within the RUM Unit and analyze groundwater samples for COPCs.	Only one well has been completed within the RUM Unit in 100-F/IU-2/IU-6. Data are needed to confirm that the RUM Unit serves as an aquitard and that groundwater within the RUM Unit is not contaminated.

Table 4-5. 100-F/IU-2/IU-6 Data Gaps

Data Gap	Data Gap No.	Data Need	Description	Additional Data Collection Recommended?	Scope of Work	Justification
Data are needed for a better understanding of hydrogeological conditions, aquifer and surface water interactions, and contaminant mobility through the vadose zone.	7	Geological characterization, physical, and hydraulic property data are needed to support modeling and analysis.	On selected soil samples, evaluate hydraulic and other properties, analyze target compound concentrations, and perform batch leach tests. Analyze groundwater samples collected during drilling for COPCs., Collect soil and groundwater samples from the (1) vadose zone, (2) deep vadose zone, (3) rewetted zone, (4) shallow unconfined aquifer, (5) deep unconfined aquifer above the RUM Unit, and (6) within the RUM Unit.	Yes	Drill and sample soil and groundwater from the three new wells (Figure 4-1). Drill Wells 1 and 2 to a depth of 5 m (15 ft) into the RUM Unit, and drill Well 3 to a depth of 15 m (50 ft) into the RUM Unit. Screen Well 3 in the first water-bearing zone encountered in the RUM Unit. Analyze soil samples collected from the vadose zone, unconfined aquifer, and RUM Unit and analyze groundwater samples from the unconfined aquifer and the RUM Unit (if sufficient water is available for sampling) per the SAP. Install and monitor pressure transducers in selected wells to determine horizontal hydraulic gradient and vertical gradient.	Data are needed to support fate and transport modeling and evaluate the causes of contaminant persistence.
Data are needed to reduce the uncertainty in the nature and spatial and temporal distribution of groundwater contamination.	8	Reduce uncertainty in assessing risks posed by groundwater contamination.	Obtain groundwater data that are spatially representative of the area, that aid evaluation of river stage influence, and are inclusive of all COPCs.	Yes	Collect and analyze groundwater samples from 55 groundwater monitoring wells in 100-F/IU-2/IU-6 to characterize the nature and extent, and temporal variability, of groundwater contamination. Three rounds of groundwater sampling will be conducted, during high, low, and transitional river stage. Wells are shown in Figures 4-2 and 4-3. Details are presented in the SAP (DOE/RL-2009-43).	Groundwater data are needed to assess the full suite of COPCs and evaluate spatial and temporal uncertainties associated with the RCBRA. Many of the wells are sampled to also achieve objectives of the 200 Area groundwater OUs; sampling and analysis are coordinated to avoid duplication of effort.

Note:

a. DOE/RL-2000-59, *Sampling and Analysis Plan for Aquifer Sampling Tubes*

COPC = contaminant of potential concern

Cr(VI) = hexavalent chromium

FSB = Fuel Storage Basin

OU = Operable Unit

RCBRA = River Corridor Baseline Risk Assessment

RUM = Ringold Formation Upper Mud Unit

SAP = Sampling and Analysis Plan

Sr-90 = Strontium-90

4.3.1 100-F/IU-2/IU-6 Data Gaps – Vadose Zone

Remediation of the 259 waste sites in 100-F/IU-2/IU-6 began in 1999 under the authority of an interim ROD. As of December 2009, 173 of the 259 waste sites have been characterized, remediated, and interim closed or evaluated (i.e., rejected or not accepted as waste sites) in accordance with the interim action ROD or other regulatory guidance. The remaining waste sites have an accepted or discovery site status, which generally means limited evaluation and cleanup have been performed. The extent of remaining contamination within the vadose zone is unknown in several areas within the area, as discussed in Data Gaps No. 1 through No. 3.

Data Gap No. 1*: Data are needed to refine the CSM of contaminant distribution beneath un-remediated waste sites.*

Background and Justification: Not all waste sites in 100-F/IU-2/IU-6 have been remediated. Data collected from these remaining sites will provide information needed to assess the potential for adverse impacts through direct exposure or contaminant transport to groundwater from remaining residual contamination.

Remediation will primarily consist of RTD, which will generate additional characterization data to address many of the current data gaps and help refine overall site knowledge. Contaminated soil and debris will be removed and disposed at the ERDF or other offsite facility (as appropriate) until the cleanup levels are met.

Excavation activities are guided by data obtained through field measurements or quick-turnaround laboratory analyses performed concurrently with the excavation and used to continually update the site characteristics databases. This cleanup approach also provides opportunities for discovery of new waste sites that will be incorporated into the remediation plans.

Sequencing of waste site cleanup is based on the Tri-Party Agreement (Ecology et al., 1989a) milestone framework. Within this framework, knowledge of operational process (e.g., sodium dichromate use) and past releases may be used to target and prioritize specific waste sites or areas with contaminants that presently exist in or potentially impact groundwater. Effective implementation of waste site cleanup prevents further degradation of groundwater, thereby increasing the likelihood for success of other remedial actions (e.g., pump-and-treat) directed specifically at contaminated groundwater.

Table 4-6. Summary of Proposed 100-F/IU-2/IU-6 Remedial Investigation/Feasibility Study Work Plan Characterization

Type	Number
New boreholes (vadose zone)	3
New wells (unconfined aquifer)	2
New wells (extending into the RUM Unit)	1
Current monitoring wells (sampling to support risk characterization)	55

Note:

RUM = Ringold Upper Mud

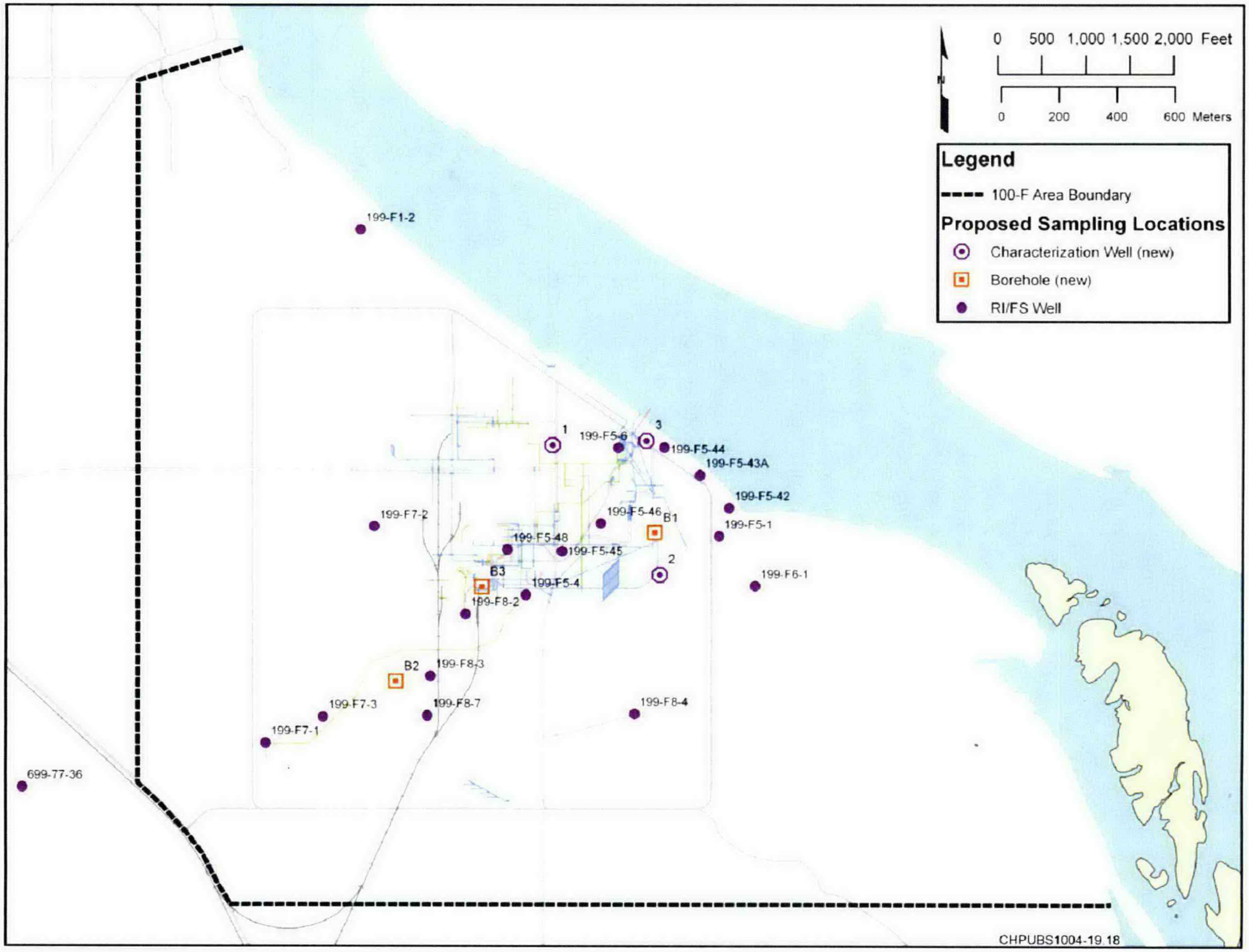
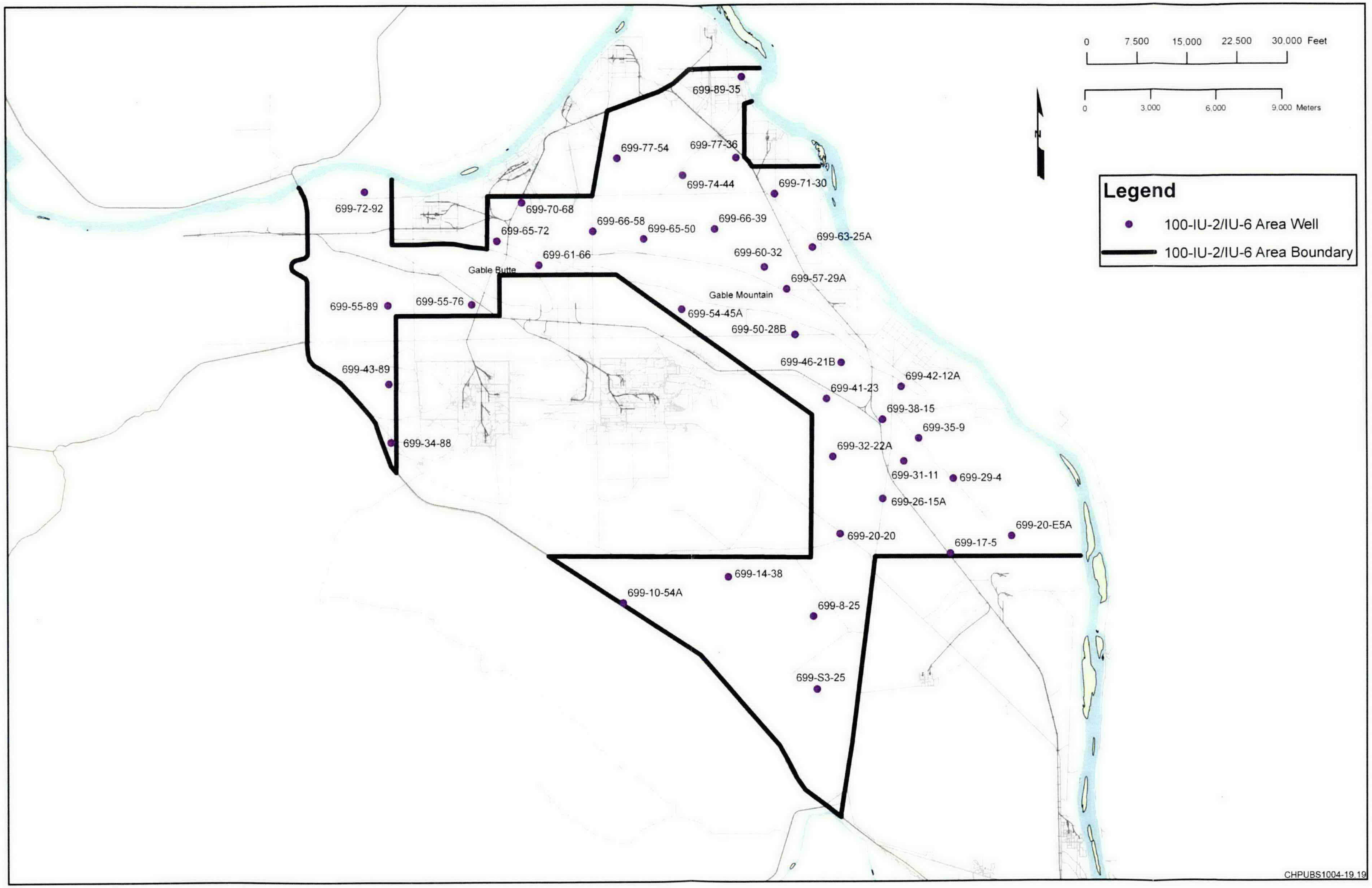


Figure 4-1. Proposed Field Sampling Locations for 100-F



Note: See Figure 4-1 for well locations in 100-F.

Figure 4-2. Proposed 100-IU-2/IU-6 Groundwater Sampling Locations

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Scope of Work: Continue interim remedial actions, as they have been demonstrated to efficiently obtain the necessary data during remediation, including data documenting residual contamination following completion of RTD. Data gaps associated with soil remedial actions will be met by planning and scheduling the remedial actions, collecting data to verify cleanup of waste sites, and obtaining concurrence from regulators on the achievement of remedial action goals relative to direct exposure, protection of groundwater, and protection of surface water.

100-F-59 Special Case. The 100-F-59 Burn Pit is a non-radiological accepted waste site located within the riparian zone adjacent to the Columbia River. The site is under water about 6 months of the year. Remedial action by excavation was performed on a portion of this site to depth of the water table, which is less than 0.6 m (2 ft) bgs during low river stage. Verification sampling indicates that contamination exceeds remedial action goals for soil to the depth of remedial action. Because the site is within the river, remedial action goals for sediment may apply to this site; remedial action goals for sediment have not been established. A site-specific assessment shall be performed to determine if existing data and sampling plans will support both human health and ecological evaluations. Contingent upon the findings of the evaluation, data collection and/or site-specific assessment shall be performed to support final remedy selection.

Data Gap No. 2: *Data are needed to refine the CSM of contaminant distribution beneath remediated waste sites.*

Background and Justification: To determine which waste sites may require further characterization to address CSM uncertainties regarding the nature and extent of contamination and contaminant fate and transport, all of the waste sites were placed into three general categories based on current site status. Site status provides an indicator of the cleanup progress and future evaluation that may be required.

- Category 1 includes sites with a status of rejected or not accepted. No further characterization is typically required at these sites because the areas of concern either: (1) meet applicable cleanup standards or closure requirements, or (2) were determined to not be a waste site according to RL-TPA-90-0001, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)." Seventy-five sites have a status of rejected or not accepted (Appendix B). As additional remediation and characterization are not required at category 1 sites, no additional effort is planned in this RI.

- Category 2 includes sites with a status of accepted or discovery. There are 86 sites in this category, which includes sites that generally have not been remediated and interim closed or otherwise have not been addressed according to the interim ROD. Accepted and discovery sites will be characterized and evaluated (as applicable) through the efforts of other programs such as the River Corridor Field Remediation Project.

- Category 3 includes sites with a status of closed out and interim closed (i.e., has been remediated according to the interim action ROD). There are 98 waste sites in this category that are considered for additional characterization in 100-F/IU-2/IU-6 area RI/FS.

- Further analysis and evaluation was then conducted to determine which sites may need further characterization. Interim closed, closed, or no actions sites were evaluated. Those sites that were identified for further characterization in the RI were selected because of characterization deficiencies (i.e., COPCs were not analyzed) or the existence of other conditions. These conditions include the presence of residual contamination, amount of data available, and the volume of liquid at the waste site, among others. The description of the process for this evaluation follows.

Step 1: The first step was to eliminate sites that had a rejected or not accepted reclassification status, were part of an active facility, or were actively being remediated (Table 4-7).

Table 4-7. Waste Sites Dropped from Further Consideration by Step 1

100-F-1	600-122	600-164	600-183	600-207
100-F-17	600-123	600-165	600-184	600-209
100-F-21	600-126	600-166	600-185	600-234
100-F-28	600-130	600-167	600-189	600-24
100-F-30	600-135	600-168	600-192	600-240
100-F-32	600-136	600-169	600-193	600-250
100-F-40	600-138	600-170	600-194	600-251
100-F-41	600-153	600-171	600-195	600-26
100-F-5	600-157	600-172	600-196	600-263
100-F-6	600-158	600-173	600-198	600-27
100-F-8	600-159	600-174	600-199	600-304
116-F-13	600-160	600-175	600-20	600-31
118-F-9	600-161	600-177	600-200	600-50
132-F-2	600-162	600-179	600-203	UPR-600-18
600-121	600-163	600-180	600-206	UPR-600-19

Step 2: Review available site data (WIDS, CVPs, RSVPs, LFI) for sites with a no action, interim closed out, or closed out reclassification status to identify sites with potential data missing for primary risk driver COPCs. This includes consideration of missing analyses and exceedances of applicable PRG values. Table 4-8 shows the sites that were eliminated at this step.

Table 4-8. Waste Sites Dropped from Further Consideration by Step 2

100-F-10	100-F-42	118-F-3	600-191
100-F-11	100-F-43	118-F-5	600-201
100-F-15	100-F-54	118-F-6	600-204
100-F-16	100-F-7	118-F-7	600-208
100-F-18	116-F-1	128-F-1	600-239
100-F-2	116-F-10	1607-F2	600-98
100-F-20	116-F-16	1607-F5	600-99
100-F-23	116-F-3	600-107	628-1
100-F-24	116-F-4	600-110	UPR-100-F-2
100-F-25	116-F-5	600-129	UPR-100-F-3
100-F-29	116-F-7	600-131	
100-F-36	116-F-8	600-139	
100-F-4	118-F-2	600-181	

Step 3: From the list of remaining waste sites, those waste sites that had exceedances of PRG values for contaminants with high soil-partitioning affinity, and that had little or no liquid use were eliminated from further evaluation. Table 4-9 presents these sites.

Table 4-9. Waste Sites Dropped from Further Consideration by Step 2

100-F-12	116-F-15	600-111
100-F-31	118-F-1	600-128
100-F-35	118-F-4	600-132
100-F-37	120-F-1	600-190
100-F-38	132-F-1	600-23
100-F-50	141-C	600-52
100-F-52	1607-F1	JA JONES 1
100-F-53	1607-F4	UPR-600-11
100-F-9	1607-F6	UPR-600-16

Step 4: From the list of remaining waste sites, those sites that already have sufficient vertical characterization data from interim remediation or other characterization data were eliminated from further evaluation. Table 4-10 lists those sites and indicates the type of characterization data that was collected.

Table 4-10. Waste Sites Dropped from Further Consideration by Step 3

116-F-2	Previous characterization borehole
116-F-6	Previous characterization borehole
116-F-9	Previous characterization test pits and borehole

The remaining waste sites requiring additional characterization are presented in Table 4-11. The existing contaminant data collected from the vadose zone was obtained from depths no greater than 9.1 m (30 ft) bgs, with a few exceptions. The available data indicate the need to better characterize the vadose zone beneath select waste sites and assess the vertical extent of vadose zone contamination.

Characterization is needed to validate interim remedial action and address uncertainty regarding the nature and extent of residual contamination in the vadose zone. Additional information on each waste site and a detailed description for each is provided under the associated data gap.

Table 4-11. Remaining Waste Sites for Further Characterization

100-F-14	Localized residual contamination sufficiently characterized
100-F-19	Sufficient existing characterization of residual contaminant concentrations
100-F-33	Localized residual contamination sufficiently characterized
100-F-34	Localized residual contamination sufficiently characterized
116-F-11	Sufficient existing characterization of residual contaminant concentrations

Table 4-11. Remaining Waste Sites for Further Characterization

116-F-12	Sufficient existing characterization of residual contaminant concentrations
116-F-14	Selected for RI borehole
126-F-1	Localized residual contamination sufficiently characterized
126-F-2	Analogous to 118-F-1
128-F-2	Sufficient existing characterization of residual contaminant concentrations
128-F-3	Localized residual contamination sufficiently characterized
132-F-3	Analogous to 118-F-1
132-F-4	Analogous to 118-F-1
132-F-5	Analogous to 118-F-1
132-F-6	Analogous to 118-F-1
1607-F3	Sufficient existing characterization of residual contaminant concentrations
1607-F7	Sufficient existing characterization of residual contaminant concentrations
182-F	Sufficient existing characterization of residual contaminant concentrations
UPR-100-F-1	Sufficient existing characterization of residual contaminant concentrations

Scope of Work: Two boreholes will be drilled to fill this data gap and obtain the data needed to refine the CSM (Table 4-12). Soil samples will be collected during drilling and analyzed to assess the vertical extent of contamination in the vadose zone beneath select waste sites. Soil samples will be collected and analyzed to assess the nature of contamination immediately below the depth of remedial action. This scope of work will also be used to gather data identified in data gap No. 7. Soil samples will be collected and analyzed as described in the SAP (DOE/RL-2009-43). The locations of the boreholes and waste sites of interest are shown in Figure 4-1. Boreholes for this data gap are identified as B1 and B2.

Boreholes samples will be screened in the field for radiological contamination and Cr(VI). Radiological screening will be conducted with field instruments. Screening for Cr(VI) will be performed visually and assumed present, as indicated by soil staining. Analytical testing will be conducted on samples for COPCs as outlined in the SAP (DOE/RL-2009-43).

Table 4-12. Borehole and Test Pit Locations and Justification for Data Gap No. 2

Waste Site	Site Status	Characterization Description	Justification for Inclusion
116-F-14 Retention Basin	Interim Closed	Borehole B1	This site was a high-volume liquid site at which significantly leakage was reported and effluent reached groundwater during operations. LFI soil concentrations (cadmium, copper, total chromium, zinc, and mercury) exceeded Hanford Site background concentrations. This site has a high residual Cr(VI) concentrations relative to other remediated sites and the CVP verification soil contamination increased with depth. This site is also located near the Sr-90 plume.
118-F-1 Burial Ground	Interim Closed	Borehole B2	This was a primary burial ground and suspected of being the source of a Cr(VI) and tritium plume detected in the 1990s.

Note:

Cr(VI) = Hexavalent chromium

CVP = cleanup verification package

LFI = limited field investigation

Sr-90 = strontium-90

Soil samples from boreholes will be collected for chemical and radiological analysis at 1.5 m (5 ft) intervals from the bottom of the waste site (or the maximum depth of remedial action). Continuous sampling will be performed within 3 m (10 ft) of the water table. A soil and filtered water sample will also be collected 1.5 m (5 ft) into the aquifer. Opportunistic groundwater samples will be collected from borings as described under Task No. 1, described in Section 4.3.3. Additional samples may be collected at the discretion of the geologist or sampler, based on field screening results. Specific sample intervals and COPCs are defined in the SAP (DOE/RL-2009-43). Boreholes will be decommissioned after sample collection.

Data Gap No. 3: *Data are needed to refine the CSM of contaminant distribution beneath and around reactor structures.*

Background and Justification: Many facilities within 100-F/IU-2/IU-6 have undergone D4 and the reactor has been placed in ISS. Waste sites that are identified as part of the facility removal process are remediated using RTD under the interim action ROD. This process has resulted in limited characterization of the soil beneath the reactor structure. Because contaminants passed through the reactor or were produced in the reactor as part of operations, contaminants may be present beneath the reactor at concentrations that pose risk to human health or ecological receptors. Insufficient data are available to assess the potential contamination beneath the reactor.

The 118-F-8 Reactor FSB was selected for additional characterization because of documented leaks at that location and decision-maker recommendations to characterize the structures beneath the reactor. Remediation of the 118-F-8 Reactor FSB included the removal of the subsurface structure and disposal of contaminated materials, including soil underlying the former FSB floor and side slopes. Contaminant data were collected to a depth of 6.4 m (21.5 ft) bgs.

Scope of Work: Drill one borehole (Borehole B3, Figure 4-1) near the118-F-8 Reactor FSB in an area most likely to contain soil contamination. Collect and analyze soil samples for target analytes analysis to assess the vertical extent of contamination in the vadose zone.

Screen samples in the field for radiological contamination and Cr(VI). Radiological screening will be conducted with field instruments. Screening for Cr(VI) will be performed visually and assumed to be present as indicated by soil staining.

Collect soil samples at 1.5 m (5 ft) intervals beginning at the bottom of the waste site/engineered structure (or maximum depth of remedial action). Collect soil samples on a continuous basis from a depth of 3 m (10 ft) above the water table to the water table. Also collect soil and groundwater samples 1.5 m (5 ft) into the aquifer. Additional samples may be collected at the discretion of the geologist or sampler based on field screening results. Specific sample intervals and analytical sampling requirements are defined in the SAP (DOE/RL-2009-43).

4.3.2 100-F/IU-2/IU-6 Data Needs - Groundwater

Data needs specific to groundwater are identified and described in this section. Data needs include analytical needs (e.g., laboratory sample results), other quantitative data (e.g., hydrogeologic, geochemical parameters), and qualitative data needs (e.g., decision data needs, policy data needs, and information data needs). Proposed groundwater monitoring wells are described in Table 4-5 and discussed in more detail below.

Data Gap No. 4: *The nature and extent of contamination in the unconfined aquifer above cleanup standards has not been fully defined in all areas or for all COPCs.*

Background and Justification: Groundwater contamination has been detected at concentrations above water quality standards in the unconfined aquifer in 100-F/IU-2/IU-6. The extent of contamination (e.g., Cr(VI)) has not been defined spatially in the unconfined aquifer. In addition, not all groundwater COPCs are routinely monitored.

Concentrations of several contaminants in groundwater are greater than drinking water standards (40 CFR 141) or standards for protection of aquatic receptors. EPA expects to return usable groundwater to its beneficial uses wherever practical, within a period that is reasonable, given the particular circumstances of the site. When restoration of groundwater to beneficial uses is not practical, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated groundwater and evaluate further risk reduction (40 CFR 300.430(a)(1)(iii)(F), "General").

Analyzing samples from new and existing wells for COPCs will provide data on the nature and extent of groundwater contamination. Groundwater quality data collected during drilling of new wells will determine how deep in the aquifer contamination is found. In addition, groundwater elevation data will be used to evaluate groundwater and plume flow directions.

Scope of Work: Install two new wells in the unconfined aquifer (Figure 4-1). Well 1 is located to further define the extent of Cr(VI) contamination as the extent of Cr(VI) to the west of Well 199-F5-6 is not known. Well 2 is positioned to further define the extent of Sr-90 contamination as the extent of Sr-90 to the south of the 116-F-14 Retention Basin is not known. In addition, groundwater elevation data will be used to evaluate groundwater and plume flow directions. Sampling and analysis details are provided in the SAP.

During well installation, collect the following data:

- Split-spoon soil samples from the vadose zone, within the unconfined aquifer, and prior to and after entering the RUM Unit. (Data Gaps No. 2, No. 3, and No. 7 describe analysis of soil samples.)

- Water samples from various depths within the unconfined aquifer to determine the vertical distribution of COPCs within the aquifer.

- Samples from existing monitoring wells for all groundwater COPCs (Tables 4-3 and 4-4). Details are found in the SAP (DOE/RL-2009-43).

Data Gap No. 5: *Contaminant concentrations entering the Columbia River are not well known.*

Background and Justification: Groundwater discharge to the river at concentrations above aquatic cleanup levels (e.g., for Cr(VI)) has been documented in 100-F. The near-shore groundwater conditions are directly affected by river stage. Limited data are available to adequately understand groundwater flow paths, contaminant migration, and mixing in the near-shore area. A wide range of mixing ratios has been observed (SGW-39305, *Technical Evaluation of the Interaction of Groundwater with the Columbia River at the Department of Energy Hanford Site, 100-D Area*) from upwelling water at the bottom of the river and groundwater at near-shore locations. This mixing ratio represents a continuum from pure groundwater to pure river water, depending on when and where in the groundwater pathway measurement is taken. The current dilution factor allowed by the interim action ROD is 1:1. The TPA Action Plan, Appendix D, Milestone M-016-110-T01, "New and Accelerated Groundwater and Columbia River Protection Hanford Federal Facility Agreement and Consent Order Milestones" (Ecology et al., 1989a,), requires compliance with cleanup standards in the hyporheic zone, thus more data from near-shore wells and aquifer tubes will be gathered to quantify groundwater-river water mixing behavior, addressing this uncertainty in establishing remediation goals.

Scenarios for plume discharge to the river vary widely because of seasonality and dynamic conditions in the zone of interaction. The greatest contaminant flux and highest concentrations at exposure locations are postulated to occur during periods of low river stage, when the groundwater hydraulic gradient toward the river is steepest and mixing between river water and groundwater is minimal. Additional physical, chemical, and biological process data and ongoing monitoring information may be needed to adequately understand the features and transport processes associated with the zone of interaction, their potential impact to aquatic receptors, and to support remedy decisions.

Aquifer tubes have been installed to analyze groundwater contaminant concentrations discharging to the river. These aquifer tubes are will continue to be analyzed for contaminants once per year.

Scope of Work: Continue routine sampling of existing aquifer tubes per the SAP for Aquifer Sampling Tubes (DOE/RL-2000-59, *Sampling and Analysis Plan for Aquifer Sampling Tubes*).

Data Gap No. 6: *The fate and transport of contaminants beneath the unconfined aquifer has not been evaluated sufficiently over the 100-F/IU-2/IU-6 Area.*

Background and Justification: The RUM Unit underlies the unconfined aquifer in 100-F/IU-2/IU-6. The RUM Unit consists primarily of clayey silt and silty clay, with lenses of silty sand and sandy silt. Only one well (199-F5-43B) in 100-F has been completed in the RUM Unit (or hydrogeologic units beneath it). Thus, groundwater flow directions and velocities in the RUM Unit are not well defined. Groundwater from the RUM Unit may discharge to aquatic receptors or to an aquifer that will be used as a drinking water resource in the future. Additional data collection from the RUM Unit is needed to evaluate contamination, determine hydrogeologic characteristics, and evaluate contaminant fate and transport.

Groundwater from well 199-F5-43B in the RUM Unit has been sampled for constituents that include organics, inorganics, and radionuclides. This well is located downgradient of the 116-F-9 Trench and relatively close to the shoreline (adjacent to well 199-F5-43A, Figure 4-1). Since sampling was initiated in 1995, groundwater contaminants have not been detected above cleanup standards.

The RUM Unit is currently considered an aquitard. The continuity and integrity of the aquitard and potential transport within the RUM Unit have not been fully evaluated. Additional data collection from soil borings and wells is proposed to evaluate the continuity of the RUM Unit, its hydrologic properties, and contamination concentrations. These data are needed to confirm that the RUM Unit serves as an aquitard, and determine what, if any, contaminants exist within the RUM Unit.

Scope of Work: During drilling for installation of Wells 1, 2, and 3 (Figure 4-1), soil samples within the RUM Unit will be collected for analysis for physical and hydraulic properties, as well as for the presence and leachability of target analytes, described as follows for Data Gap No. 7. During drilling for each of the three new wells, soil samples will be collected above the unconfined aquifer, within the unconfined aquifer, just above the RUM Unit, and 1.5 m (5 ft) into the RUM Unit. At Well 3, at least two additional samples will be collected prior to reaching terminal depth (approximately 15 m [50 ft] into the RUM Unit).

The Well 3 proposed location was selected because it is within the footprint of the Cr(VI) plume exceeding cleanup standards in the unconfined aquifer; the intent is to evaluate whether Cr(VI) is also present in the RUM Unit beneath the contaminated unconfined aquifer.

The SAP provides details of sampling and analyses requirements for the groundwater and soil samples collected during drilling.

Data Gap No. 7: *Data are needed for a better understanding of hydrogeological conditions, aquifer surface water interactions, and contaminant mobility through the vadose zone.*

Background and Justification: Geological characterization and hydraulic property data are needed to support modeling and site assessment. This includes developing a better understanding of hydrogeological conditions in the aquifers and of interactions between the different aquifers and between aquifers and surface water. These data will provide the basis for better understanding contaminant fate and transport.

The fate and transport of Cr(VI) are largely dependent on the effluent volume discharged and contaminant K_d. Hexavalent chromium typically has a very low contaminant K_d (near zero); thus, it tends to move through the vadose zone with the effluent discharged to the soil column. However, studies indicate that this constituent can be retarded in the vadose zone, depending on source characteristics and iron concentrations.

In addition to release of contaminants to the environment associated with effluent discharge during reactor operations, contaminant fate and transport is affected by changes in groundwater elevations. The periodically rewetted zone is the area where the water level in a well fluctuates throughout the year. The river stage changes relatively rapidly on various time scales (e.g., hourly, daily, and seasonally). Groundwater elevations in the unconfined aquifer and the RUM Unit respond to changes in river stage near the river. River stage influence is observed up to several hundred meters inland, including in areas where the elevated Cr(VI) concentrations have been detected. During times of high river stage (and therefore high groundwater table elevations), contaminants such as Cr(VI) suspended in the periodically rewetted zone can be re-mobilized to groundwater at unknown rates and concentrations. Thus, the rewetted zone may be a continuing source of the relatively high concentrations of chromium observed in groundwater. Conversely, during low river stage, contaminants in groundwater are left suspended on the soil matrix, likely dissolved within residual soil moisture.

The site-specific distribution coefficient for Cr(VI) needs to be further evaluated to support assessments of contaminant fate and transport in the environment. In addition, the distribution coefficients of other COPCs need to be evaluated. Site-specific values for additional soil properties are needed to support input parameters for fate and transport calculations and modeling.

Soil and water analyses are also needed to determine the potential for each hydrogeologic unit to contain sufficient contamination to be a continuing source of groundwater contamination. Multiple hypotheses have been proposed to explain the persistent nature of Cr(VI) and Sr-90 detected in groundwater.

Scope of Work: Drill and sample soil and groundwater from the three proposed monitoring wells and the three proposed boreholes described previously, in accordance with the SAP (DOE/RL-2009-43). Evaluate the following soil and hydraulic properties of soil samples collected during drilling:

- Unsaturated soil
  - Moisture content
  - Grain size distribution
  - Bulk density
  - Porosity
- Saturated soil
  - Grain size distribution
  - Bulk density
  - Porosity
  - Saturated hydraulic conductivity
  - pH

During installation of the three new wells, collect soil and water samples throughout the thickness of the unconfined aquifer and the top of the RUM Unit as described previously. Soil samples will be collected at intervals of 1.5 m (5 ft), as defined previously under Data Gaps No. 2 and No. 3, and additional samples may be collected based on field observations. Samples will be analyzed for radiological and chemical constituents as described in the SAP (DOE/RL-2009-43).

Install pressure transducers in the new Well 3 and a nearby shallow well to obtain information about vertical hydraulic gradients. Install and monitor pressure transducers in selected other wells to determine horizontal and vertical hydraulic gradients. To determine the K_d for Cr(VI), conduct batch leach tests on selected soil samples collected during drilling at each of the three new borings and three new well locations, in accordance with the SAP.

Perform batch leach tests on samples from the following locations at the three new boreholes and three new wells:

- Above the unconfined aquifer (for boreholes and wells)
- Within the unconfined aquifer (for boreholes and wells)
- Within the unconfined aquifer just above the RUM Unit (for wells only)
- Immediately on entering the RUM Unit (for wells only)
- Deeper locations within the RUM Unit at Well 3 (for wells only)

The SAP (DOE/RL-2009-43) contains a detailed description of the analyses planned. Analyses for wells are the same as those listed previously for boreholes.

Data Gap No. 8: *Data are needed to reduce the uncertainty in spatial and temporal distribution of groundwater contamination.*

Background and Justification: To evaluate human health and ecological risk uncertainties associated with the RCBRA, the RI process requires that groundwater data be collected to evaluate spatial and temporal variability in groundwater conditions. Groundwater must be sampled throughout the area without regard to the location of surface facilities or known groundwater plumes. If there are temporal changes in groundwater conditions, samples must be collected to appropriately evaluate this variability in order to properly identify risk to receptors.

Sampling well locations must be identified to spatially represent all of the area, regardless of facility or known contaminant plume locations. These sampling networks should represent locations where human or ecological receptors could potentially come into contact with groundwater. Any discussion of potential residential use of the land at this location is solely for the purpose of analyzing risk and planning a sampling program. The primary pathway for human exposure is through direct contact with groundwater obtained from residential or community water wells. Identification of sampling locations to assess the direct exposure pathways is based on the assumption that the land will be developed for future human habitation.

Based on remedial action goals for the interim action ROD (DOE/RL-96-17, *Remedial Design Report/ Remedial Action Work Plan for the 100 Area*), the assumption for future habitation is a rural residential scenario, which assumes that families will live on the land, grow a garden, and raise livestock to provide approximately 25 percent of the family's food requirements. This land usage places specific state and daily water requirements for each residence. The remedial action goals are based on groundwater restored to drinking water standards. It is also assumed at least a 2 ha (5-ac) plot per unit is necessary to raise livestock. Thus, each residence in the following scheme assumes a family plot size of 2 ha (5 ac).

To estimate the appropriate number of sampling points for a monitoring well network, the average site-specific groundwater yields are used to determine the number of residences that may be supported by one water supply well. Thus, the site-specific grid size is determined. Use of a random grid generator provides approximate locations for sampling points based on the final number of sampling points and the total area.

In addition to determining the maximum number and location of potential exposure pathways, additional wells are added to the sampling network to help define risk associated with known contaminant plumes. Monitoring wells were chosen to provide data on the maximum contaminant concentrations present and to better delineate the define plumes.

Scope of Work: Three rounds of groundwater samples will be collected for field screening and COPC analysis, per the SAP (DOE/RL-2009-43), from the network of wells shown in Figures 4-1 and 4-2. This network has been established to appropriately characterize groundwater conditions for the future land use scenario just described. Three sampling rounds will be conducted during seasonal high, low, and transitional river stages, for a total of three samples per well. Each round of monitoring in the network of wells and aquifer tubes for this area will be completed within 30 consecutive calendar days to minimize variability in water conditions. Groundwater elevations will be measured during each sampling round to support evaluation of groundwater flow directions and velocities.

4.3.3 100-F/IU-2/IU-6 – Additional Scope of Work

The following tasks will be conducted as part of the scope of work under this RI/FS. These tasks are not specifically related to a data gap, but will enhance the understanding of the site and support development of potential remediation options.

Task No. 1: Opportunistic groundwater sampling will be conducted at borehole locations.
Boreholes will be installed in various locations within 100-F/IU-2/IU-6, as described previously. The purpose of these boreholes is for vadose zone characterization and to satisfy specific soil-related data gaps. However, groundwater sampling from these boreholes may also be possible during drilling. In order to maximize the amount of data available for decision making, groundwater samples will be collected from boreholes to the extent possible. Conditions that may limit sampling may include limited groundwater production or borehole collapse during sampling. Groundwater sampling will be conducted as outlined in the SAP (DOE/RL-2009-43), for analysis for the full suite of groundwater COPCs. Samples will be collected in the order of priority specified in the SAP, due to the possibility of limited water availability. Data resulting from such sampling will be used to enhance the understanding of contaminant distribution within 100-F/IU-2/IU-6.

Task No. 2: Develop list of potential remediation technologies.
Groundwater contamination above aquatic standards (Cr(VI)) and drinking water standards (nitrate, TCE, and Sr-90) have been detected in 100-F/IU-2/IU-6. No groundwater remedial actions are currently being implemented. The RI Work Plan will collect data necessary for development and evaluation of potential final remedies as part of the FS. As part of the RI/FS study process, a comparison of potential groundwater and/or soil remediation technologies will be necessary if contamination above applicable cleanup and/or risk levels remains after completion of the RI. The project expectation is that the aquifer will be returned to highest beneficial use (i.e., drinking water) and that the land will be suitable for residential development.

A list of remedial technologies that are applicable to 100-F/IU-2/IU-6 will be generated as part of the FS. Soil samples from new boreholes and wells will be archived so that future analyses could be performed to support specific data needs for technology and remedy comparison. In addition, remedial technologies have been evaluated for various contaminants found within 100-F/IU-2/IU-6 at other Hanford OUs, including 100-HR-3, 100-NR-2, and 200-ZP-1 OUs. The remedial technologies that will be evaluated for the FS can potentially be used as a sole remedy or in conjunction with other technologies. Potentially applicable treatment technologies for Cr(VI) in soil and groundwater have been evaluated for 100-D (SGW-38338, *Remedial Process Optimization for the 100-D Area Technical Memorandum*), and remedial technologies for Sr-90 and tritium have been were evaluated for the 100-NR-2 and 200-ZP Groundwater OUs.

Task No. 3: Update bathymetric data for the river within 100-F/IU-2/IU-6 to support calculations of contaminant transport to the river and ecological receptors.
Ecological receptors (e.g., salmon redds) have been identified within the river. In order to evaluate groundwater contaminant flow pathways to receptors (particularly from beneath the unconfined aquifer), updated and accurate bathymetric data for the river are needed.

Based on current knowledge of the RUM Unit's top surface elevations from inland wells, as well as from river bathymetric data evaluated to date, the top of the RUM Unit is believed to intersect the river channel, toward the bottom of the channel in 100-F/IU-2/IU-6; however, more detailed bathymetric data and geologic information are needed to confirm this. Additional bathymetric data adjacent to 100-F/IU-2/IU-6 have been collected but not yet evaluated. These data will be evaluated to better define the river bathymetry. The bathymetric data will then be combined with groundwater fate and transport analysis to evaluate contaminant transport and risks to specific ecological receptors.

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5 Project Schedule

The project schedule for activities discussed in this addendum is shown in Figure 5-1. This schedule will serve as the baseline for the planning process and will be used to measure the implementation progress of this process. Any updates to the project schedule will be reflected in the annual work planning process and are not anticipated to require a revision to this addendum.

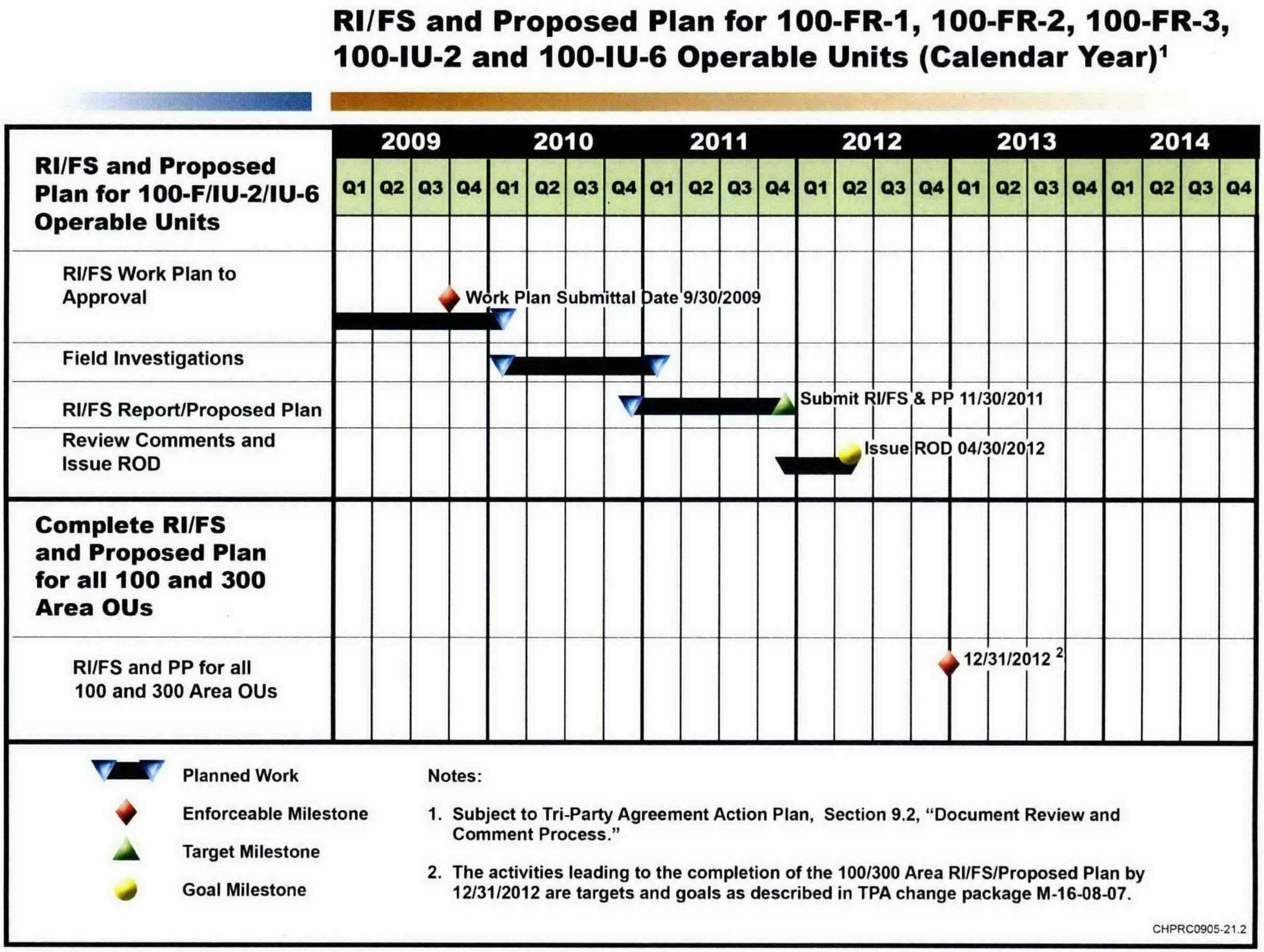

Figure 5-1. 100-F/IU-2/IU-6 Project Schedule

6 References

40 CFR 131, "Water Quality Standards," Code of Federal Regulations._Available at: http://www.access.gpo.gov/nara/cfr/waisidx_09/40cfr131_09.html.

40 CFR 141, "National Primary Drinking Water Regulations," Code of Federal Regulations. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_09/40cfr141_09.html.

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_09/40cfr300_09.html.

40 CFR 300.430(e)(9)(iii), "National Oil and Hazardous Substances Pollution Contingency Plan," "Remedial Investigation/Feasibility Study and Selection of Remedy," "Feasibility Study," *Code of Federal Regulations*. Available at: http://edocket.access.gpo.gov/cfr_2009/julqtr/40cfr300.430.htm.

40 CFR 300.430(a)(1)(iii)(F), "National Oil and Hazardous Substances Pollution Contingency Plan," "Remedial Investigation/Feasibility Study and Selection of Remedy," "General," *Code of Federal Regulations*. Available at: http://edocket.access.gpo.gov/cfr_2009/julqtr/40cfr300.430.htm.

58 FR 48509, "Record of Decision: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington," *Federal Register*, Vol. 58, p. 48509, September 16, 1993.

Atomic Energy Act of 1954, 42 USC 2011, et seq. Available at: http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0980/ml022200075-vol1.pdf.

BHI-00146, 1995, *100-IU-6 Operable Unit Technical Baseline Report*, Rev. 00, Bechtel Hanford, Inc., Richland, Washington.

BHI-00185, 1995, *Technical Reevaluation of the N-Springs Barrier Wall*, Rev. 00, Bechtel Hanford Inc. Richland, Washington.

BHI-00448, 1995, *White Bluffs, 100-IU-2 Operable Unit Baseline Technical Report*, Rev. 0, Bechtel Hanford, Inc. Richland, Washington.

BHI-00917, 1996, *Conceptual Site Models for Groundwater Contamination at the 100-BC-5, 100-KR-4, 100-HR-3, and 100-FR-3 Operable Units*, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D197142704.

BHI-01326, 1999, *Pre-Hanford Agricultural History: 1900-1943*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI-01399, 1999, *108-F Biological Laboratory D&D Project Closeout Report*, Rev. 0, Bechtel Hanford Inc. Richland, Washington.

Clean Water Act of 1972, 33 USC 1251, et seq. Available at: http://epw.senate.gov/water.pdf.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq. Available at: http://epw.senate.gov/cercla.pdf.

CVP-99-00007, *Cleanup Verification Package for 116-D-7 Retention Basin,* Rev. 0, Bechtel Hanford Inc. Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5615147.

CVP-2000-00027, *Cleanup Verification Package for 116-H-7 Retention Basin,* Bechtel Hanford Inc. Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5624133.

CVP-2001-00002, 2002, *Cleanup Verification Package for the 100-F-19:1 and 100-F-19:3 Reactor Cooling Water Effluent Pipelines, 100-F-34 Biology Facility French Drain, and 116-F-12 148-F French Drain*, Rev. 0, Appendix D, *100-F Area Soil Cr(VI) and Carbon-14 Leachability Study Summary Report,* Bechtel Hanford Inc. Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D3428958.

DOE Order 5400.5 Chg 2, *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, Washington, D.C. Available at: http://www.directives.doe.gov/pdfs/doe/doetext/oldord/5400/o54005c2.pdf.

DOE, 2001, *Hanford 100-N Area Remediation Options Evaluation Summary Report*, U.S. Department of Energy, Washington, D.C. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D9003794.

DOE/RL-90-33, 1992, *Remedial Investigation/Feasibility Study Work Plan for the 100-FR-1 Operable Unit, Hanford Site, Richland, Washington*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196105940.

DOE/RL-91-07, 1993, *Remedial Investigation/Feasibility Study Work Plan for the 100-BC-2 Operable Unit, Hanford Site, Richland, Washington.* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196136757.

DOE/RL-91-53, 1992, *Remedial Investigation/Feasibility Study Work Plan for the100-FR-3 Operable Unit, Hanford Site, Richland, Washington*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196110847 .

DOE/RL-92-23, 1992, *Hanford Site Groundwater Background*, Rev. 0A U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://www5.hanford.gov/arpir/?content=findpage&AKey=D196102655.
http://www5.hanford.gov/arpir/?content=findpage&AKey=D196121580.

DOE/RL-93-78, 1994, *Limited Field Investigation Report for the 100-KR-1 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196064658.

DOE/RL-93-80, 1995, *Limited Field Investigation Report for the 100-NR-1 Operable Unit Abatement Assessment*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196022762.

DOE/RL-93-82, 1995, *Limited Field Investigation Report for the 100-FR-1 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196005401.

DOE/RL-93-83, 1994, *Limited Field Investigation Report for the 100-FR-3 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-95-108, 1996, *Approach and Plan for Cleanup Actions in the 100-IU-2 and 100-IU-6 Operable Units of the Hanford Site*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D197142718.

DOE/RL-95-99, 1996, *100-FR-3 Groundwater/Soil Gas Supplemental Limited Field Investigation Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D197188949.

DOE/RL-96-17, 2004, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D6542354.

DOE/RL-96-39, 2002, *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://www5.hanford.gov/arpir/?content=findpage&AKey=D9039847.
http://www5.hanford.gov/arpir/?content=findpage&AKey=D9039856.
http://www5.hanford.gov/arpir/?content=findpage&AKey=D9039860.

DOE/RL-97-1047, 2002, *History of the Plutonium Production Facilities at the Hanford Site Historic District, 1943-1990*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2000-59, *Sampling and Analysis Plan for Aquifer Sampling Tubes,* Rev. 0, U.S. Department of Energy, Washington, D.C. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D8510131.

DOE/RL-2001-49, 2003, *Groundwater Sampling and Analysis Plan for the 200-BP-5 Operable Unit,* Rev. 0, U.S. Department of Energy, Washington, D.C. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D1362434.

DOE/RL-2002-39, 2002, *Standardized Stratigraphic Nomenclature for Post-Ringold Formation Sediments Within the Central Pasco Basin,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2003-04, 2005, *Sampling and Analysis Plan for the 200-PO-1 Operable Unit,* Rev. 1, U.S. Department of Energy, Rev 1, Richland Operations Office, Richland, Washington. Available at: Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA01974685.

DOE/RL-2003-49, *100-FR-3 Operable Unit Sampling and Analysis Plan,* Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0811040295.

DOE/RL-2004-37, 2005, *Risk Assessment Work Plan for the 100 Area and 300 Area Component of the RCBRA*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA01946743.

DOE/RL-2005-45, 2005, *Surplus Reactor Final Disposition Engineering Evaluation*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA00913933.

DOE/RL-2005-49, 2005, *RCBRA Stack Air Emissions Deposition Scoping Document*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA01649842.

DOE/RL-2005-93, 2005, *Remedial Design Report/Remedial Action Work Plan for the 100-N Area,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA04193451.

DOE/RL-2007-21, *Risk Assessment for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment*. U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2008-01, 2008, *Hanford Site Groundwater Monitoring Report for Fiscal Year 2007,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=detail&AKey=00098824.

DOE/RL-2008-46, 2010, *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=1002260412.

DOE/RL-2008-66, 2009, *Hanford Site Groundwater Monitoring Report for Fiscal Year 2008,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0905131281. http://www2.hanford.gov/arpir/?content=findpage&AKey=0905131282.

DOE/RL-2009-43, 2010, *Sampling and Analysis Plan for the 100-FR-1, 100-FR-2, 100-FR-3, 100-IU-2, and 100-IU-6 Operable Units Remedial Investigation/Feasibility Study,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RW-0017, 1984, *Draft Environmental Assessment: Reference Repository Location Hanford Site, Washington*, U.S. Department of Energy, Washington, D.C.

DUN-1818, 1966, *Discharge of Sodium Dichromate Solution Compliance with Executive Order 11258*, Douglas United Nuclear, Inc., Richland, Washington.

DUN-4847, 1968, *Quarterly Report Contamination Control—Columbia River April – June 1968*, Douglas United Nuclear, Inc., Richland, Washington.

DUN-6888, 1970, *Historical Events—Single Pass Reactors and Fuels Fabrication*, Douglas United Nuclear, Inc., Richland, Washington.

Ecology, EPA, and DOE, 1989a, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=90&parent=91.

Ecology, EPA, and DOE, 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=90&parent=91.

EGG-1183-1661, 1975, *An Aerial Radiological Survey of the U.S. Energy Research and Development Administration's Hanford Reservation (Survey Period: 1973-1974)*, EG&G Energy Measurements, Inc., Las Vegas, Nevada.

EPA/540/1-89/001, 1989, *Risk Assessment Guidance for Superfund Volume II Environmental Evaluation Manual: Interim Final,* U.S. Environmental Protection Agency, Washington, D.C.

EPA/540/1-89/002, 1989, *Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A): Interim Final*, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://epa.gov/swerrims/riskassessment/ragsa/pdf/rags-vol1-pta_complete.pdf.

EPA/AMD/R10-00/122, 1999, *Interim Remedial Action Record of Decision Amendment for the 100-HR-3 Operable Unit, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Available at: http://www.epa.gov/superfund/sites/rods/fulltext/a1000122.pdf.

EPA/ROD/R10-00/121, 2000, *Interim Remedial Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units, Hanford Site (100 Area Burial Grounds), Benton County, Washington*, U.S. Environmental Protection Agency, Region10, Seattle, Washington. Available at: http://www.epa.gov/superfund/sites/rods/fulltext/r1000121.pdf.

EPA/ROD/R10-99/039, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Available at: http://www.epa.gov/superfund/sites/rods/fulltext/r1099039.pdf.

ERTEC, 1981, *Cultural Resources Survey and Exploratory Excavations for the Skagit-Hanford Nuclear Power Project*, ERTEC Northwest, Seattle, Washington.

Geist, D.R., 2000, "The Interaction of Ground Water and Surface Water Within Fall Chinook Salmon Spawning Areas in the Hanford Reach of the Columbia River," in *Proceedings of the Ground-Water/Surface-Water Interactions Workshop*, vol. EPA/542/R-00/007, pp. 95-98, U.S. Environmental Protection Agency, Washington, D.C.

Geist, D.R. and D.D. Dauble, 1998, "Redd Site Selection and Spawning Habitat Use by Fall Chinook Salmon: The Importance of Geomorphic Features in Large Rivers," *Environmental Management*, Vol. 22, No. 5, pp. 655-669.

Gerber, M.S., 2007, *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site,* Fourth Edition, University of Nebraska Press, Lincoln, Nebraska. Available at: http://www.questia.com/PM.qst?a=o&d=59241681.

HAN-10970, 1945, *Construction Hanford Engineer Works U. S. Contract No. W-7412-ENG-1, DuPont Project 9536, History of the Project*, Vols. I and II, E.I. DuPont de Nemours & Company, Richland, Washington.

Hanford Waste Information Data System database, Richland, Washington.

HNF-35051, 2009, *Small Water Systems Management Program for Group A Water Systems Managed by Fluor Hanford,* Rev. 2, Fluor Hanford, Inc., Richland, Washington.

HW-3-3259, 1945, *Leaks in 107-F and 107-D Basin*, General Electric Company, Richland, Washington. Available at: http://www5.hanford.gov/pdw/fsd/AR/FSD0001/FSD0040/D196068013/D196068013_6458_2.pdf.

HW-61789, 1959, *Monthly Record Report, Irradiation Processing Department*, General Electric Company, Richland, Washington. Available at: http://www5.hanford.gov/ddrs/common/findpage.cfm?AKey=D8344223.

HW-84619, 1965, *Summary of Environmental Contamination Incidents at Hanford, 1958 – 1964*, General Electric Company, Richland, Washington. Available at: http://www5.hanford.gov/ddrs/common/findpage.cfm?AKey=D8565181.

Marceau and Sharpe, 2006, *Archaeological Activities Report: Post Review Discoveries within 45BN431 at Solid Waste Site 128-F-2.*

NAVD88, 1988, *North American Vertical Datum of 1988*, National Geodetic Survey, Federal Geodetic Control Committee, Silver Spring, Maryland.

OSR-2005-0001, 2005, *100-F Area Orphan Sites Evaluation Report,* Rev 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

OSR-2008-0001, 2009, *100-IU-2 and 100-IU-6 Areas Orphan Sites Evaluation Report*, Rev. 0, Washington Closure Hanford LLC, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0904080681.

PNL, 1989, *Archaeological Site Monitoring Form: 45BN118*, Hanford Cultural Resources Program, Pacific Northwest Laboratory, Richland, Washington.

PNL-2949, 1979, *Geology and Groundwater Quality Beneath the 300 Area, Hanford Site, Washington*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D195059349.

PNL-6456, 1988, *Hazard Ranking System Evaluation of CERCLA Inactive Waste Sites at Hanford,* 3 vols., Pacific Northwest Laboratory, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196006954. http://www5.hanford.gov/arpir/?content=findpage&AKey=D196006996. http://www5.hanford.gov/arpir/?content=findpage&AKey=D196007000.

PNL-8337, 1992, *Summary and Evaluation of Available Hydraulic Property Data for the Hanford Site Unconfined Aquifer System,* Pacific Northwest Laboratory, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D199061221.

PNL-9437, 1994, *Monitoring Groundwater and River Interaction Along the Hanford Reach of the Columbia River*, Pacific Northwest Laboratory, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196088721.

PNNL, 2001, *Archaeological Site Monitoring Form: 45BN118*, Hanford Cultural Resources Program, Pacific Northwest National Laboratory, Richland, Washington.

PNNL, 2004, *Archaeological Site Monitoring Form: 45BN118*, Hanford Cultural Resources Program, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13674, 2001, *Zone of Interaction Between Hanford Site Groundwater and Adjacent Columbia River: Progress Report for the Groundwater/River Interface Task Science and Technology Groundwater/Vadose Zone Integration Project*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnl.gov/main/publications/external/technical_reports/pnnl-13674.pdf.

PNNL-13858, 2002, *Revised Hydrogeology for the Suprabasalt Aquifer System, 200-West Area and Vicinity, Hanford Site, Washington*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnl.gov/main/publications/external/technical_reports/PNNL-13858.pdf.

PNNL-14287, 2003, *Data Quality Objectives Summary Report – Designing a Groundwater Monitoring and Assessment Network for the 100-BC-5 and 100-FR-3 Operable Units,* Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnl.gov/main/publications/external/technical_reports/PNNL-14287.pdf.

PNNL-14562, 2004, *The Hanford and White Bluffs Agricultural Landscape: Evaluation for Listing in the National Register of Historic Places,* Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14702, 2006, *Vadose Zone Hydrogeology Data Package for Hanford Assessments*, Rev. 1, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnl.gov/main/publications/external/technical_reports/PNNL-14702rev1.pdf.

PNNL-14744, 2004, *Recharge Data Package for the 2005 Integrated Disposal Facility Performance Assessment*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnl.gov/main/publications/external/technical_reports/PNNL-14744.pdf.

PNNL-16346, 2007, *Hanford Site Groundwater Monitoring for Fiscal Year 2006*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnl.gov/main/publications/external/technical_reports/PNNL-16346.pdf.

PNNL-17674, 2008, *Geochemical Characterization of Chromate Contamination in the 100 Area Vadose Zone at the Hanford Site*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnl.gov/main/publications/external/technical_reports/PNNL-17674.pdf.

PNNL-SA-53273, 2007, *Hanford Site Vadose Zone Studies: An Overview,* Pacific Northwest National Laboratory, Richland, Washington.

Relander, C., 1986, *Drummers and Dreamers*, Pacific Northwest National Forest Association, reprint of the 1956 edition, Seattle, Washington.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: http://www.epa.gov/epawaste/inforesources/online/index.htm.

Rice, D.G., 1968, *Archaeological Reconnaissance Hanford Atomic Works*, U.S. Atomic Energy Commission, National Park Service, and Washington State University, Pullman, Washington.

Rice, D.G., 1968, *Archaeological Reconnaissance: Ben Franklin Reservoir Area, 1968,* Washington State University, Laboratory of Anthropology, Pullman, Washington.

RL-REA-2247, 1965, *Historical Events, Reactors and Fuels Fabrication,* U.S. Atomic Energy Commission, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196083548.

RL-TPA-90-0001, 2007, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www.hanford.gov/files.cfm/TPA-MP14.pdf.

SGW-38338, 2008, *Remedial Process Optimization for the 100-D Area Technical Memorandum Document*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

SGW-39305, 2008, *Technical Evaluation of the Interaction of Groundwater with the Columbia River at the Department of Energy Hanford Site, 100-D Area*, Rev. 0, Fluor Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0812290631.

Slate, J.L., 1996, "Buried Carbonate Paleosols Developed in Pliocene-Pleistocene Deposits of the Pasco Basin, South-Central Washington, U.S.A.," *Quaternary International,* Vol. 34-36, pp. 191-196.

Stewardship Information System, Washington Closure Hanford, Richland, Washington. Accessed January 6, 2009.

UNI-74-25, 1974, *Leaking Check Valve-Emergency Dump Tank Bypass Line,* Occurrence Report No. 74-25, United Nuclear Industries, Inc. Richland, Washington.

UNI-946, 1978, *Radiological Characterization of the Retired 100 Areas*, United Nuclear Industries, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196008079.

WAC 173-340-705, "Model Toxics Control Act – Cleanup," "Use of Method B," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-705.

Wagoner, J.D., M.A. Wilson, R.F. Smith, 1998, *Action Memorandum for the 105-F and 105-DR Reactor Buildings and Ancillary Facilities, Hanford Site, Benton County, Washington,* U.S. Department of Energy, Richland Operations Office, Washington State Department of Ecology, U.S. Environmental Protection Agency, Region 10, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D198146374.

WCH-142, 2006, *Archaeological Activities Report: Post Review Discoveries within 45BN431 at Solid Waste Site 128-F-2,* Washington Closure Hanford, LLC, Richland, Washington.

WCH-218, 2008, *Orphan Sites Evaluation Project Execution Plan*, Washington Closure Hanford, LLC, Richland, Washington.

WCH-227, 2007, *Sampling and Analysis Instruction for Evaluation of the Distribution of Metals in the Sediments at 128-F-2 Waste Site,* Rev. 0, Washington Closure Hanford, LLC, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA06654223.

WHC-SD-EN-RA-012, 1994, *Qualitative Risk Assessment for the 100-FR-3 Groundwater Operable Unit,* Rev.0, Westinghouse Hanford Company, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196084470.

WHC-SD-EN-RPT-004, 1993, *Summary of 100 B/C Reactor Operations and Resultant Wastes, Hanford Site*, Rev. 0, Westinghouse Hanford Company, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196132831.

WHC-SD-EN-TI-023, 1992, *Hydrologic Information Summary for the Northern Hanford Site*, Rev. 0, Westinghouse Hanford Company, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196110687.

WHC-SD-EN-TI-132, 1993, *Geologic Setting of the 100-HR-3 Operable Unit, Hanford Site, South-Central Washington,* Rev. 0, Westinghouse Hanford Company, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196126259.

WHC-SD-EN-TI-133, 1993, *Geology of the 100-B/C Area, Hanford Site, South-Central Washington*, Rev. 0-A, Westinghouse Hanford Company, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196134620. http://www5.hanford.gov/arpir/?content=findpage&AKey=D196131231.

WHC-SD-EN-TI-169, 1993, *100-F Reactor Site Technical Baseline Report Including Operable Units 100-FR-1 and 100 FR-2,* Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-TI-221, 1994, *Geology of the 100-FR-3 Operable Unit, Hanford Site South-Central Washington,* Rev.0, Westinghouse Hanford Company, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196098540.

WHC-SD-ER-TI-003, 1991, *Geology and Hydrology of the Hanford Site: A Standardized Text for Use in Westinghouse Hanford Company Documents and Reports,* Rev. 0, Westinghouse Hanford Company, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D195066471.

WHC-SP-0377, 1988, *Assessment of Westinghouse Hanford Company Methods for Estimating Radionuclide Release from Ground Disposal of Waste Water at the N Reactor Sites,* Westinghouse Hanford Company, Richland, Washington. Available at: http://www.osti.gov/energycitations/purl.cover.jsp?purl=/6492544-NRpLNd/.

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Appendix A

100-F/IU-2/IU-6 Maps

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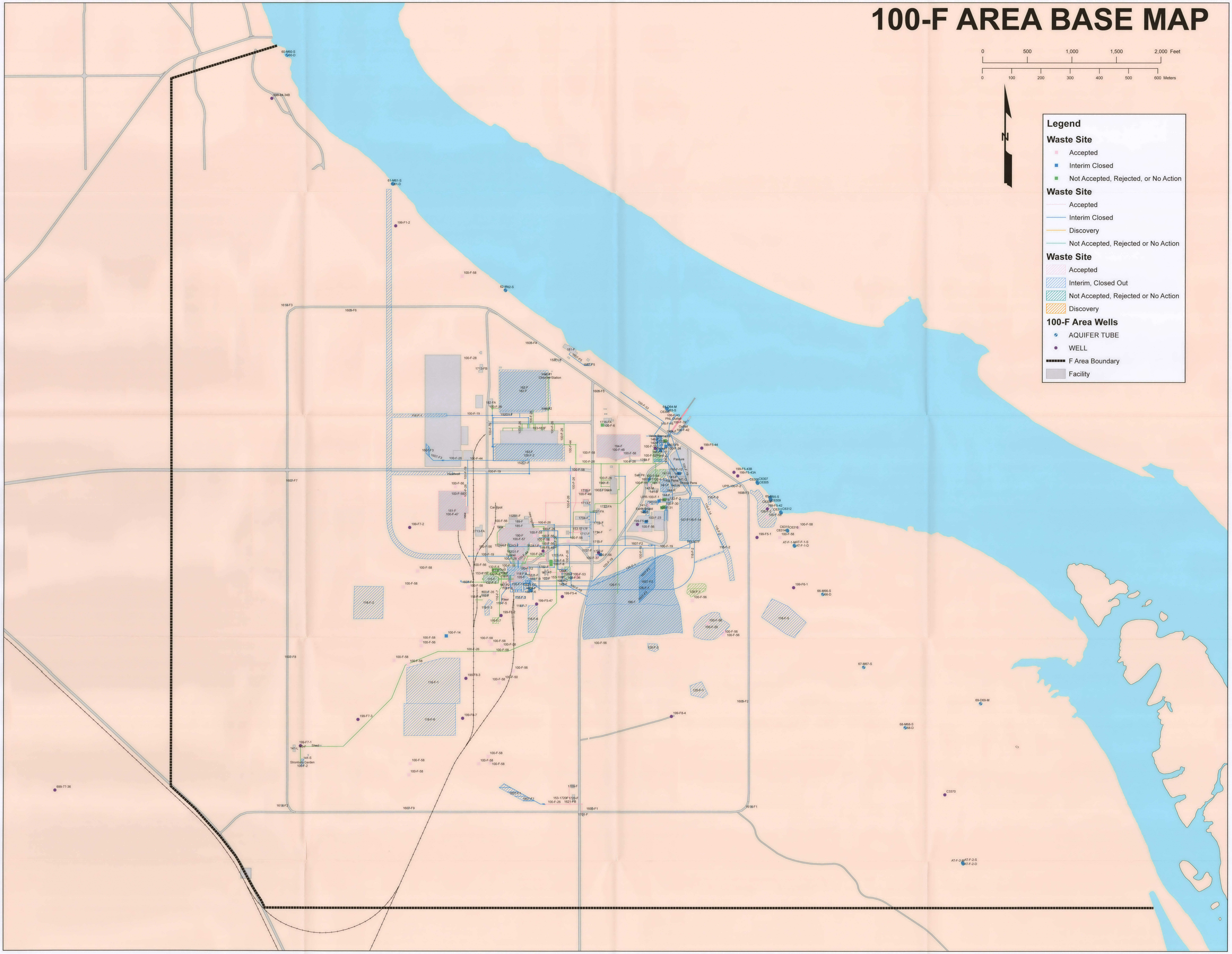
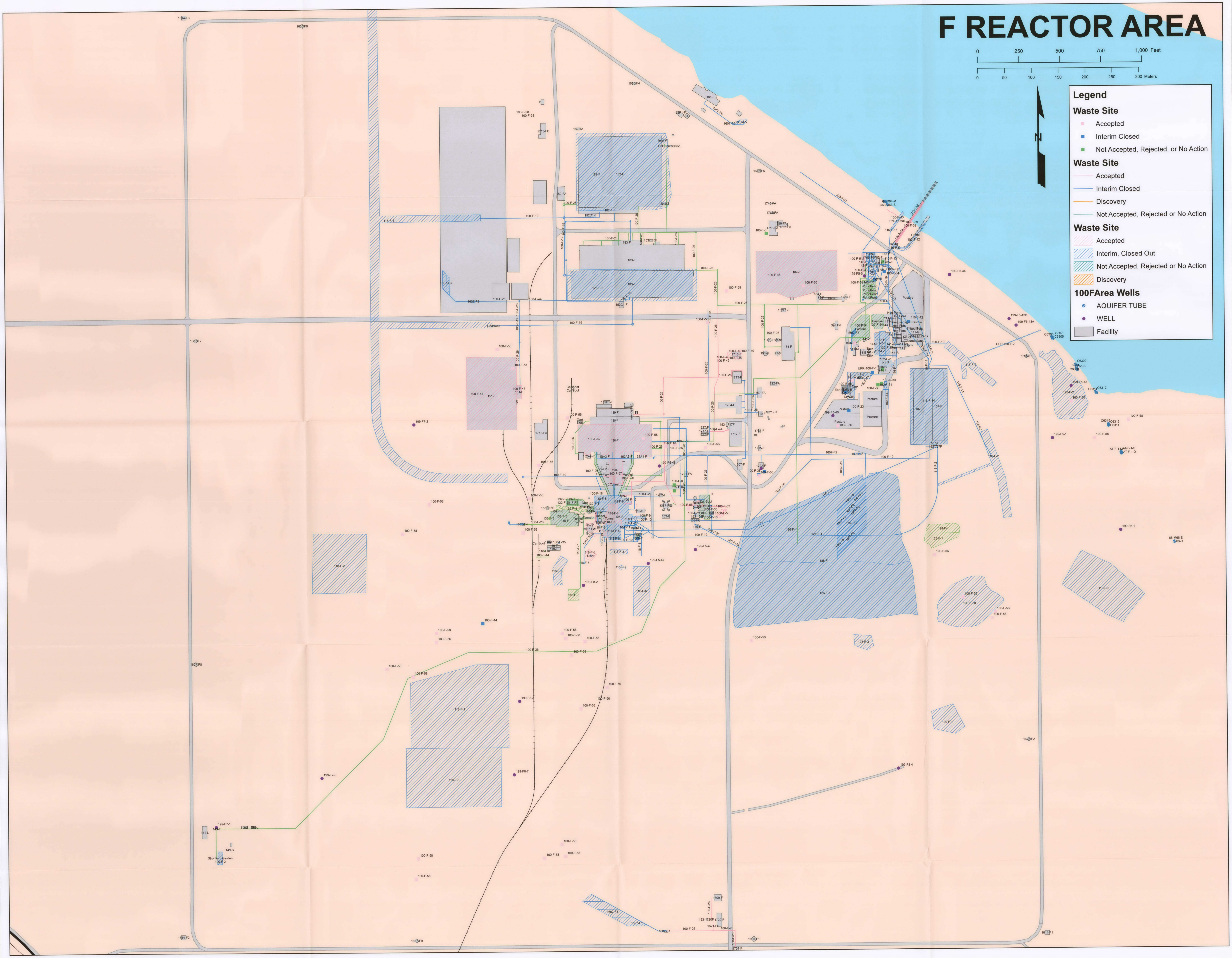
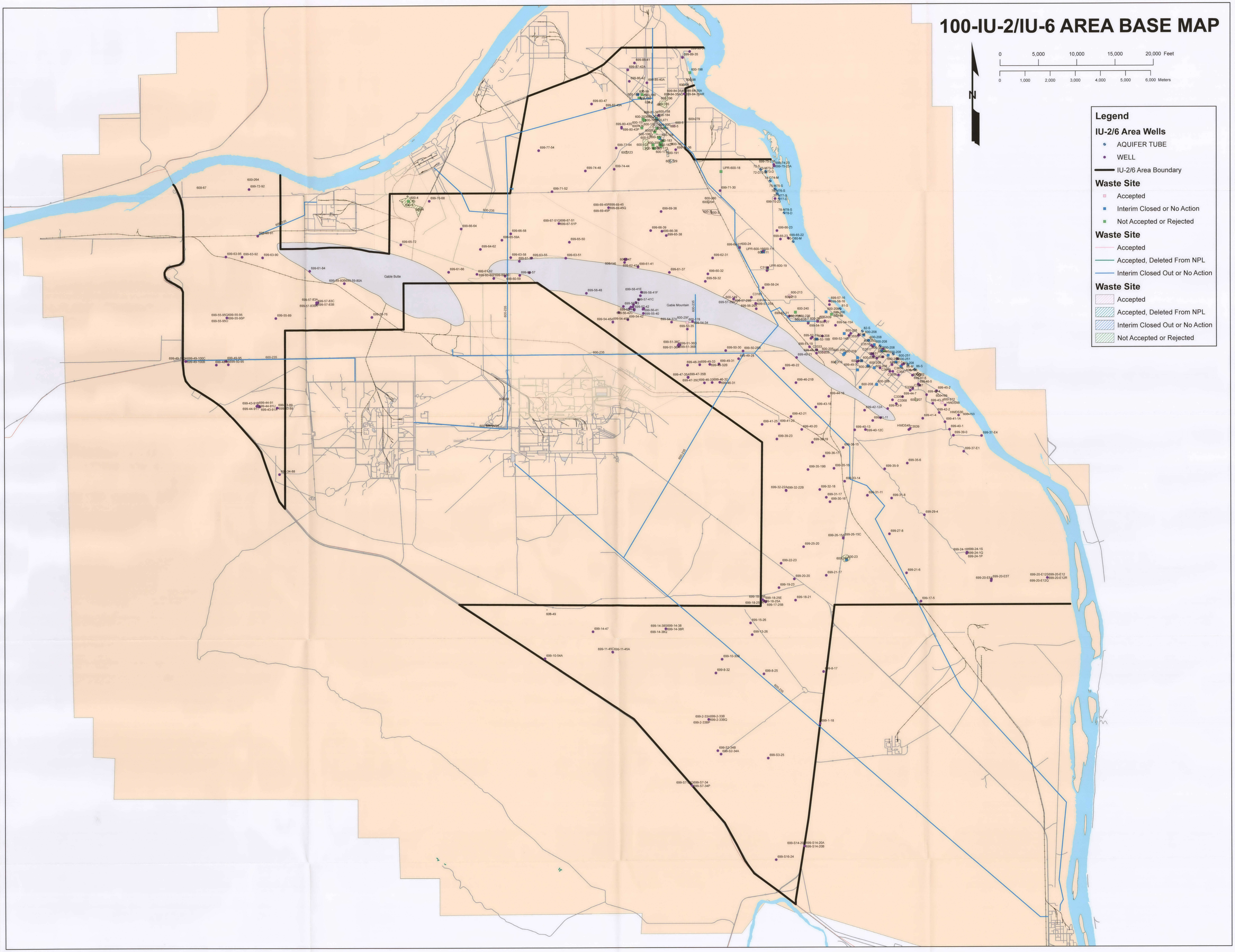

100-F AREA BASE MAP
0 500 1,000 1,500 2,000 Feet
0 100 200 300 400 500 600 Meters
N
Legend
Waste Site
Accepted
Interim Closed
Not Accepted, Rejected, or No Action
Waste Site
Accepted
Interim Closed
Discovery
Not Accepted, Rejected or No Action
Waste Site
Accepted
Interim, Closed Out
Not Accepted, Rejected or No Action
Discovery
100-F Area Wells
AQUIFER TUBE
WELL
F Area Boundary
Facility


F REACTOR AREA
0 250 500 750 1,000 Feet
0 50 100 150 200 250 300 Meters
N
Legend
Waste Site
Accepted
Interim Closed
Not Accepted, Rejected, or No Action
Waste Site
Accepted
Interim Closed
Discovery
Not Accepted, Rejected or No Action
Waste Site
Accepted
Interim, Closed Out
Not Accepted, Rejected or No Action
Discovery
100FArea Wells
AQUIFER TUBE
WELL
Facility


100-IU-2/IU-6 AREA BASE MAP
N
0 5,000 10,000 15,000 20,000 Feet
0 1,000 2,000 3,000 4,000 5,000 6,000 Meters
Legend
IU-2/6 Area Wells
AQUIFER TUBE
WELL
IU-2/6 Area Boundary
Waste Site
Accepted
Interim Closed or No Action
Not Accepted or Rejected
Waste Site
Accepted
Accepted, Deleted From NPL
Interim Closed Out or No Action
Waste Site
Accepted
Accepted, Deleted From NPL
Interim Closed Out or No Action
Not Accepted or Rejected
Gable Butte
Gable Mountain

Appendix B

100-F/IU-2/IU-6 Waste Sites Description and History

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B1 Introduction

Table B-1 provides a summary of the codes, types, and status of waste sites in 100-F/IU-2/IU-6. Table B-1 also provides physical dimensions, dates of operation, a brief history for each site, and relevant decision/remedial action information, if available.

B2 References

BHI-00448, 1995, *White Bluffs, 100-IU-2 Operable Unit Baseline Technical Report*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI-01399, 2000, *108-F Biological Laboratory D&D Project Closeout Report*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

CVP-2001-00001, 2002, *Cleanup Verification Package for the 100-F-2 Strontium Garden*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D9147680.

CVP-2001-00002, 2002, *Cleanup Verification Package for the 100-F-19:1 and 100-F-19:3 Reactor Cooling Water Effluent Pipelines, 100-F-34 Biology Facility French Drain, and 116-F-12 French Drain*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D3428958.

CVP-2001-00003, 2003, *Cleanup Verification Package for the 100-F-19:2 Reactor Cooling Water Effluent Pipeline, 116-F-11 Cushion Corridor French Drain, UPR-100-F-1 Sewer Line Leak, and 100-F-29 Experimental Animal Farm Process Sewer Pipelines,* Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5613085.

CVP-2001-00005, 2003, *Cleanup Verification Package for the 116-F-2, 107-F Liquid Waste Disposal Trench*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D1169096.

CVP-2001-00006, 2001, *Cleanup Verification Package for the 116-F-4 Pluto Crib*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D8930444.

CVP-2001-00007, 2001, *Cleanup Verification Package for the 116-F-5 Ball Washer Crib*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5627222.

CVP-2001-00008, 2002, *Cleanup Verification Package for the 116-F-9 Animal Waste Leaching Trench*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D9181193.

CVP-2001-00009, 2002, *Cleanup Verification Package for the 116-F-14 Retention Basin*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D9121762.

CVP-2001-00010, 2001, *Cleanup Verification Package for the 1607-F-6 Septic System and Pipelines*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D8930454.

CVP-2001-00011, 2002, *Cleanup Verification Package for the UPR-100-F-2 Basin Leak Ditch*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D9061468.

CVP-2001-00019, 2001, *Cleanup Verification Package for the JA Jones 1 Site*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D8930471.

CVP-2001-00020, 2001, *Cleanup Verification Package for the 600-23 Dumping Area*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D8930482.

CVP-2002-00001, 2002, *Cleanup Verification Package for the 100-F-4, 100-F-11, 100-F-15, and 100-F-16 French Drains*, Rev. 0, Bechtel Hanford, Inc. Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D9147683.

CVP-2002-00004, 2007, *Cleanup Verification Package for the 126-F-1, 184-F Powerhouse Ash Pit,* Rev. 1, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06101373.

CVP-2002-00005, 2003, *Cleanup Verification Package for the 1607-F2 Septic System,* Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D1168993.

CVP-2002-00007, 2003, *Cleanup Verification Package for the 100-F-35 Soil Contamination Site*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5627628.

CVP-2002-00008, 2003, *Cleanup Verification Package for the 116-F-3 Fuel Storage Basin Trench*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5627740.

CVP-2002-00009, 2003, *Cleanup Verification Package for the 116-F-1 Lewis Canal*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

CVP-2002-00010, 2003, *Cleanup Verification Package for the 116-F-6 Liquid Waste Disposal Trench*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

CVP-2003-00003, 2003, *Cleanup Verification Package for the 116-F-10, 105-F Dummy Decontamination French Drain,* Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5627844.

CVP-2003-00010, 2003, *Cleanup Verification Package for the 100-F-25, 146-FR Drywells and the UPR-100-F-3 Mercury Spill*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5628092.

CVP-2003-00011, 2003, *Cleanup Verification Package for the 100-F-23, 141-C Drywell*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5628197.

CVP-2003-00012, 2003, *Cleanup Verification Package for the 100-F-24, 145-F Drywell*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5628309.

CVP-2003-00017, 2004, *Cleanup Verification Package for the 118-F-8:1, 105-F Reactor Below-Grade Structures and Underlying Soils; the 118-F-8:3, 105-F Fuel Storage Basin Underlying Soils; and the 100-F-10 French Drain,* Rev. 0, Bechtel Hanford, Inc., Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5632072. http://www5.hanford.gov/arpir/?content=findpage&AKey=D5632386. http://www5.hanford.gov/arpir/?content=findpage&AKey=D5633244. http://www5.hanford.gov/arpir/?content=findpage&AKey=D5633573.

CVP-2006-00007, 2006, *Cleanup Verification Package for the 118-F-7, 100-F Miscellaneous Hardware Storage Vault,* Rev. 0, Washington Closure Hanford, LLC, Richland, Washington.

CVP-2006-00008, 2006, *Cleanup Verification Package for the 118-F-3, Minor Construction Burial Ground,* Rev. 0, Washington Closure Hanford, LLC, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA04316706.

CVP-2006-00009, 2007, *Cleanup Verification Package for the 100-F-20, Pacific Northwest Laboratory Parallel Pits,* Rev. 0, Washington Closure Hanford, LLC, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA04485283.

CVP-2007-00001, 2007, *Cleanup Verification Package for the 118-F-1 Burial Ground,* Rev. 0, Washington Closure Hanford, LLC, Richland, Washington. Available at: http://www5.hanford.gov/pdw/fsd/AR/FSD0001/FSD0042/DA06587512/1.PDF.

CVP-2007-00002, 2007, *Cleanup Verification Package for the 118-F-2 Burial Ground,* Rev 0, Washington Closure Hanford, LLC, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06834544.

CVP-2007-00003, 2008, *Cleanup Verification Package for the 118-F-5 PNL Sawdust Pit,* Rev. 0, Washington Closure Hanford, LLC, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0805290309.

CVP-2007-00004, 2007, *Cleanup Verification Package for the 118-F-8:4 Fuel Storage Basin West Side Adjacent and Side Slope Soils,* Rev. 0, Washington Closure Hanford, LLC, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0804030111.

CVP-2008-00001, 2008, *Cleanup Verification Package for the 118-F-6 Burial Ground,* Rev. 0, Washington Closure Hanford, LLC, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0810230114.

DOE/RL-94-61, 1998, *100 Area Source Operable Unit Focused Feasibility Study*, Appendix N, "Remedy Selection Process for Remaining Source Operable Unit Waste Sites," Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D198209199.

EPA/ROD/R10-00/121, 2000, *Interim Remedial Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units, Hanford Site (100 Area Burial Grounds), Benton County, Washington*, U.S. Environmental Protection Agency, Region10, Seattle, Washington. Available at: http://www.epa.gov/superfund/sites/rods/fulltext/r1000121.pdf.

EPA/ROD/R10-99/039, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington.* U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Available at: http://www.epa.gov/superfund/sites/rods/fulltext/r1099039.pdf.

HAN-10970, 1945, *Construction of Hanford Engineer Works: History of the Project*, Vols. 1-4, E.I. duPont de Nemours and Company, Wilmington, Delaware.

OSR-2005-0001, 2005, *100-F Area Orphan Sites Evaluation Report,* Rev. 0, Washington Closure Hanford, LLC, Richland Washington.

RL-TPA-90-0001, 2007, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www.hanford.gov/files.cfm/TPA-MP14.pdf.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303.

Wagoner, J.D., M.A. Wilson, R.F. Smith, 1998, *Action Memorandum for the 105-F and 105-DR Reactor Buildings and Ancillary Facilities, Hanford Site, Benton County, Washington,* U.S. Department of Energy, Richland Operations Office, Washington State Department of Ecology, U.S. Environmental Protection Agency, Region 10, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D198146374.

WSRF 97-001, 1997, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 100-F-5, 1717-F Building Drywell, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA06723873.

WSRF 97-002, 1997, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 100-F-8, French Drains near 105-F Gate, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723875.

WSRF 97-006, 1997, *Waste Site Reclassification Form,* Operable Unit 100-FR-2, Waste Site ID 600-31, Bottle Disposal Site, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723877.

WSRF 97-015, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-172, White Bluffs French Drain or Dry Well, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723663.

WSRF 97-016, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-173, White Bluffs Domestic Debris Dump and Building Foundations, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723667.

WSRF 97-017, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-174, White Bluffs French Drain, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723670.

WSRF 97-018, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-175, Original Priest Rapids Ice House Drain Field, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723672.

WSRF 97-019, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-177, White Bluffs Pipe Bender and Equipment Dumping Area, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723683.

WSRF 97-020, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-179, Priest Rapids Ice House, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723685.

WSRF 97-021, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-180, White Bluffs Suspect Automotive Repair Shop, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723689.

WSRF 97-022, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-183, White Bluffs Burn Pile and Debris, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723692.

WSRF 97-023, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-184, White Bluffs Townsite Septic System, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723694.

WSRF 97-025, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-193, White Bluffs Gas Station, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723697.

WSRF 97-026, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-194, White Bluffs Main Pipe Fabrication and Blacksmith Shop, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723699.

WSRF 97-027, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-200, Priest Rapids Ice House Septic Tank, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723703.

WSRF 97-028, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-203, White Bluffs French Drains, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723706.

WSRF 97-029, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-209, White Bluffs Excess Railroad Tie Materials, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723708.

WSRF 97-030, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-20, Tank Cleaning Site, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723710.

WSRF 97-031, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-24, West P-11, anti-Aircraft Artillery Compound, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723717.

WSRF 97-032, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-26, Hanford Townsite Burn Pile, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723746.

WSRF 97-033, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-50, Hanford Construction Camp Coal Yard (101 Building), U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723749.

WSRF 97-034, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-185, Hanford Construction Honey Dump Site, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723752.

WSRF 97-035, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-206, 101 Building Graphite Dump Site, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723761.

WSRF 97-036, 1997, *Waste Site Reclassification Form*, Operable Unit 100-IU-6, Waste Site Code UPR-600-18, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

WSRF 97-037, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site Code UPR-600-19, Lime Sulfur Barrel, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723767.

WSRF 97-038, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-207, Hanford Construction Camp Powerhouse Ash Pile, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723776.

WSRF 97-039, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-121, White Bluffs Coal Ash Piles, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723543.

WSRF 97-041, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-27, Abandoned Monitoring Well; Well DC-6; Well 699-50-18C, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723778.

WSRF 97-042, 1998, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-135, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723661.

WSRF 97-043, 1998, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-189, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723658.

WSRF 97-044, 1997, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-199, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06723655.

WSRF 2001-018, 2001, *Waste Site Reclassification Form*, Operable Unit 100-IU-6, Waste Site ID 600-240, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

WSRF 2001-030, 2003, *Waste Site Reclassification Form*, Operable Unit 100-FR-2, Waste Site ID 100-F-28, with attachments, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D2985783.

WSRF 2001-095, 2002, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 100-F-40, Animal Farm Surface Impoundment, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D9003807.

WSRF 2003-033, 2004, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-107, with attachment, "Waste Site Evaluation for 600-107, 213-J and 213-K Cribs," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4854875.

WSRF 2003-048, 2003, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-181, with attachment, "Waste Site Evaluation for 600-181 White Bluffs Oil Dump Site," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4855145.

WSRF 2003-25, 2003, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 132-F-3, with attachment, "Waste Site Evaluation for 132-F-3, 115-F Gas Recirculation Facility," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4854420.

WSRF 2003-28, 2003, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-52, with attachment, "Waste Site Evaluation for 600-52, White Bluffs Surface Basin," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4854828.

WSRF 2003-29, 2003, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 132-F-5, with attachment, "Waste Site Evaluation for 132-F-5, 117-F Filter Building," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4854840.

WSRF 2003-32, 2003, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 132-F-6, with attachment, "Waste Site Evaluation for 132-F-6, 1608-F Waste Water Pumping Station," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4854858.

WSRF 2003-35, 2003, *Waste Site Reclassification Form,* Operable Unit 100-FR-2, Waste Site ID 128-F-1 Burn Pit, with attachment, "Waste Site Evaluation for 128-F-1 Burn Pit," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4854912.

WSRF 2003-37, 2003, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-99, with attachment, "Waste Site Evaluation for 600-99 JA Jones 2," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4854933.

WSRF 2003-38, 2003, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-201, with attachment, "Waste Site Evaluation for 600-201 White Bluffs Paint and Solid Waste Disposal Site," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4854947.

WSRF 2003-39, 2003, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-128, with attachment, "Waste Site Evaluation for 600-128, White Bluffs Oil and Oil Filter Dump Site," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D2985591.

WSRF 2003-40, 2003, *Waste Site Reclassification Form*, Operable Unit 100-IU-2, Waste Site ID 600-132, White Bluffs Contractor Shop Landfill, with attachment, "Waste Site Evaluation for 600-132 White Bluffs Construction Contractor Shop Landfill," U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D2985656.

WSRF 2003-41, 2003, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-139, with attachment, "Waste Site Evaluation for 600-139 Automotive Repair Shop," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D2963815.

WSRF 2003-43, 2003, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-204, with attachment, "Waste Site Evaluation for 600-204 Hanford Townsite Burn and Burial Trench," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4855026.

WSRF 2003-45, 2003, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-131, with attachment, "Waste Site Evaluation for 600-131 Fabrication Shops," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D2985632.

WSRF 2003-46, 2003, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 628-1, with attachment, "Waste Site Evaluation for 628-1 White Bluffs Burn Pit," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4855094.

WSRF 2003-47, 2003, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-190 Tar and/or Paint Site, with attachment, "Waste Site Evaluation for 600-190 Tar and/or Paint Site," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D4855117.

WSRF 2004-062, 2004, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-110, with attachment, "Remaining Sites Verification Package for 600-110 Hanford Townsite Landfill," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D5920865.

WSRF 2004-065, 2008, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site Code 600-111, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0812180783.

WSRF 2004-093, 2004, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 100-F-38, with attachment, "Remaining Sites Verification Package for the 100-F-38, Stained Soil Site," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA02171852.

WSRF 2004-095, 2004, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 100-F-37, with attachment, "Remaining Sites Verification Package for the 100-F-37, French Drain Discovered Near Hydrant F-2," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D6054224.

WSRF 2004-096, 2004, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-208, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D7933650.

WSRF 2004-098, 2004, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site ID 600-98, with attachment, "Remaining Sites Verification Package for 600-98 East White Bluffs City Landfill," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D6054247.

WSRF 2004-124, 2005, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 100-F-7, with attachment, "Remaining Sites Verification Package for the 100-F-7 Underground Fuel Tank for the 1705-F Building," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D7648984.

WSRF 2004-125, 2005, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 100-F-9, with attachment, "Remaining Sites Verification Package for the 100-F-9 French Drain at the East End of the 105-F Storage Room," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D7648987.

WSRF 2004-126, 2005, *Waste Site Reclassification Form*, Operable Unit 100-FR-1, Waste Site ID 100-F-12, with attachment "Remaining Sites Verification Package for the 100-F-12 French Drain," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D7648990.

WSRF 2004-127, 2005, *Waste Site Reclassification Form*, Operable Unit 100-FR-2, Waste Site ID 100-F-14, with attachment, "Remaining Sites Verification Package for the 100-F-14, 100-FR-2 Vent Pipe, 100-F Carpenter Shop Vent Pipe," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=D7852325.

WSRF 2004-128, 2005, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 116-F-7, Seal Pit Water Crib, with attachment, "Remaining Sites Verification Package for the 116-F-7 Seal Pit Water Crib," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D7648996.

WSRF 2004-129, 2005, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 118-F-4, with attachment, "Remaining Sites Verification Package for the 118-F-4, 115-F Pit," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D7649000.

WSRF 2004-130, 2008, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site Code 1607-F1, with attachment, "Remaining Sites Verification Package for the 1607-Fl Sanitary Sewer System (124-F-1) and the 100-F-26:8 (1607-Fl) Sanitary Sewer Pipelines Waste Sites," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0804220049.

WSRF 2004-131, 2007, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site Code 1607-F4, with attachment, "Remaining Sites Verification Package for the 1607-F4 Sanitary Sewer System," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA06476730.

WSRF 2004-136, 2005, *Waste Site Reclassification Form,* Operable Unit 100-IU-2, Waste Site ID 600-129 and 600-191, with attachment, "Remaining Sites Verification Package for the 600-129 and 600-191, White Bluffs Pre-Manhattan Engineering District (MED) Community Dump Sites 1 and 2," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D7648979.

WSRF 2004-137, 2005, *Waste Site Reclassification Form*, Operable Unit 100-FR-1, Waste Site ID 100-F-18, with attachment, "Remaining Sites Verification Package for the 100-F-18 Condensate Drain Field and Underground Tank," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D7648993.

WSRF 2005-008 Attachment, 2005, *Remaining Sites Verification Package for the 100-F-26:1 North Process Sewer Collection Pipelines,* Rev. 0, Attachment to Waste Site Reclassification Form 2005-008, Washington Closure Hanford, LLC, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA694512.

WSRF 2005-025, 2005, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 182-F, with attachment, "Remaining Sites Verification Package for the 182-F Reservoir Waste Site," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA01648546.

WSRF 2005-043, 2005, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 132-F-4:2, 116-F Reactor Stack Base Burial, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA01648619.

WSRF 2005-044, 2005, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 116-F-7:2, 117-F Crib Pipeline, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA01648621.

WSRF 2006-017, 2006, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 126-F-2, with attachment, "Remaining Sites Verification Package for the 126-F-2,183-F Clearwells," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA02604338.

WSRF 2006-021, 2006, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 100-F-33, with attachment, "Remaining Sites Verification Package for the 100-F-33, 146-F Aquatic Biology Fish Ponds," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA03633571.

WSRF 2006-027, 2006, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 141-C, with attachment, "Remaining Sites Verification Package for the 141-C Large Animal Barn and Biology Laboratory (Hog Barn)," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA02754894.

WSRF 2006-029, 2008, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 132-F-1, with attachment, "Remaining Sites Verification Package for the 132-F-1, 141-F Chronic Feeding Sheep Barn," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA03630611.

WSRF 2006-033, 2005, *Waste Site Reclassification Form*, Operable Unit 100-FR-1, Waste Site ID 100-F-31, with attachment, "Remaining Sites Verification Package for the 100-F-31, 144-F Sanitary Sewer System," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA03633660.

WSRF 2006-033, 2005, *Waste Site Reclassification Form*, Operable Unit 100-FR-1, Waste Site ID 100-F-31, with attachment, "Remaining Sites Verification Package for the 100-F-31, 144-F Sanitary Sewer System," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA03633660.

WSRF 2006-038, 2006, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 116-F-8, with attachment, "Remaining Sites Verification Package for the 116-F-8, 1904-F Outfall Structure and the 100-F-42, 1904-F Spillway," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA03897516.

WSRF 2006-038 Attachment, 2006, *Remaining Sites Verification Package for the 116-F-8, 1904-F Outfall Structure and the 100-F-42, 1904-F Spillway*, Rev. 0, Attachment to Waste Site Reclassification Form 2006-038, Washington Closure Hanford, LLC, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA03897516.

WSRF 2006-039, 2006, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 116-F-16, with attachment, "Remaining Sites Verification Package for the 116-F-16, PNL Outfall and the 100-F-43, PNL Outfall Spillway," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA03768158.

WSRF 2006-039 Attachment, 2006, *Remaining Sites Verification Package for the 116-F-16, PNL Outfall and the 100-F-43, PNL Outfall Spillway,* Rev. 0, Attachment to Waste Site Reclassification Form 2006-039, Washington Closure Hanford, LLC, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA03768158.

WSRF 2006-040, 2006, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 1607-F7, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA04084188.

WSRF 2006-042, 2008, *Waste Site Reclassification Form,* Operable Unit 100-FR-2, Waste Site ID 128-F-3, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA05805787.

WSRF 2006-043, 2006, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 1607-F5, with attachment, "Remaining Sites Verification Package for the 1607-F5 Sanitary Sewer System (124-F-5)," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA03768299.

WSRF 2006-045, 2006, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site ID 100-F-42, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA05805743.

WSRF 2006-047, 2007, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site Code 1607-F3, with attachment, "Remaining Sites Verification Package for the 1607-F3 Sanitary Sewer System," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA05001340.

WSRF 2006-048, 2005, *Waste Site Reclassification Form,* Operable Unit 100-FR-2, Waste Site ID 118-F-9, with Attachment 1, "118-F-9 Waste Site and Vicinity," Attachment 2, "March, 1962 Aerial Photograph of 100-F Area" and "December, 1973 Aerial Photograph of 100-F Area," Attachment 3 "Geophysical Survey Results," and Attachment 4, "118-F-9 Analytical Data Results," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA03633328.

WSRF 2006-064, 2007, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site Code 100-F-41 (including subsites 1 through 4), with attachment, "Description of 100-F-41 Subsites 1 through 4," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA04508712.

WSRF 2007-001, 2008, *Waste Site Reclassification Form*, Operable Unit 100-FR-2, Waste Site Code 100-F-50, with attachment, "Remaining Sites Verification Package for the 100-F-50 Stormwater Runoff Culvert," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA06723873.

WSRF 2007-002, 2007, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site Code 100-F-36, with attachment, "Remaining Sites Verification Package for the 100-F-36, 108-F Biological Laboratory, and for the 116-F-15, 108F Radiation Crib," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=DA05186824.

WSRF 2007-005, 2007, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site Code 100-F-44:1, with attachment, "Description of 100-F-44:1 Subsite," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA05001332.

WSRF 2007-010, 2007, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site Code 100-F-44:3, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA05805859.

WSRF 2007-011, 2007, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site Code 100-F-44:11, with attachment, "Description of the 100-F-44:10, 141-C Sewer Pipelines Subsite," U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=DA05973778.

WSRF 2008-015, 2008, *Waste Site Reclassification Form*, Operable Unit 100-FR-1, Waste Site Code 100-F-54, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www2.hanford.gov/arpir/?content=findpage&AKey=0805120067.

WSRF 2008-019, 2009, *Waste Site Reclassification Form*, Operable Unit 100-FR-1, Waste Site Code 100-F-53, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

WSRF 2008-022, 2008, *Waste Site Reclassification Form*, Operable Unit 100-FR-1, Waste Site Code 100-F-52, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

WSRF 2008-028, 2008, *Waste Site Reclassification Form*, Operable Unit 100-FR-2, Waste Site Code 120-F-1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

WSRF 2008-031, 2008, *Waste Site Reclassification Form,* Operable Unit 100-FR-1, Waste Site Code 128-F-2, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0902180709.

WSRF 2008-045, 2008, *Waste Site Reclassification Form,* Operable Unit 100-IU-6, Waste Site Code UPR-600-16, U.S. Environmental Protection Agency and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0812180782.

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
100-F Area Waste Sites																
100-F-1	Depression/ Pit (non-specific)	100-FR-2	2.44 m x 2.44 m	Not Documented	The site is a depression surrounded by a post and chain barricade with warning signs. No contamination was found during a radiological survey conducted on March 31, 1995.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
100-F-10	French Drain	100-FR-1	0.91 m (diameter)		The site is a French drain located adjacent to the southeast corner of the Miscellaneous Storage Room of the 105-F Reactor Building. The site was a vertically buried 76.2 cm (30-in.) -diameter concrete pipe. The unit was fed by one or more steel pipes coming from the 105-F Reactor Building. The 100-F-10 French Drain was removed in its entirety during excavation of the 100-F-19:2 pipeline. However, documentation of the 100-F-10 remedial action was inadvertently omitted from CVP-2001-00003. Therefore, the close-out documentation for the remediation of 100-F-10 French Drain was noted in CVP-2003-00017.	Interim Closed Out	CVP-2003-00017	See 100-F-19:2 for cleanup verification sampling results; close out documentation is in CVP-2003-00017.								
100-F-11	French Drain	100-FR-1	0.46 m (diameter)	Not Documented	The French drain was constructed of concrete pipe of unknown length. The unit had no cover and was filled with gravel. A steel pipeline entered the drain from the 108-F Building. The site was excavated and waste was disposed at ERDF as part of the D&D of the 108-F Laboratory Building in 1999. The site was not sampled to verify cleanup at that time. Site excavation was reported in BHI-01399. No material from the site was disposed at ERDF from the 2001 sampling effort because the French drain was backfilled with the overburden after sampling verification was completed.	Interim Closed Out	CVP-2002-00001	08-Aug-99	07-Feb-02	None	5.6	Pu-238	0.015U (Test Pit)	\	See 100-F-15	\
												Pu-239/240	0.015U (Test Pit)	\	See 100-F-15	\
												Chromium (total)	12 (Test Pit)	\	See 100-F-15	\
												Chromium (hexavalent)	0.41U (Test Pit)	\	See 100-F-15	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
100-F-12	French Drain	100-FR-1	0.91 m (diameter)	Not Documented	The site was a concrete pipe, buried to an unknown depth. The upper surface of the drain was a few inches above grade and had a steel lid (manhole cover). The drain was fed by five steel pipes coming from the northeast corner of the 105-F Reactor Building. Based on the pipe size, it is believed that these pipes may have been steam condensate lines associated with the building's steam heaters.	No Action	WSRF 2004-126	10/11/04 (confirmatory sampling)	10/11/04 (confirmatory sampling)	None	4	Arsenic	2.8 (<BG)	\	\	\
												Barium	68.7 (<BG)	\	\	\
												Beryllium	0.44 (<BG)	\	\	\
												Boron	0.99	\	\	\
												Cadmium	0.11 (<BG)	\	\	\
												Chromium (total)	10.5 (<BG)	\	\	\
												Cobalt	6.9 (<BG)	\	\	\
												Copper	12.9 (<BG)	\	\	\
												Lead	4.5 (<BG)	\	\	\
												Manganese	318 (<BG)	\	\	\
												Mercury	0.02 (<BG)	\	\	\
												Molybdenum	0.22	\	\	\
												Nickel	11.2 (<BG)	\	\	\
												Vanadium	45.5 (<BG)	\	\	\
												Zinc	46.1 (<BG)	\	\	\
												Aroclor-1260	0.055	\	\	\
												The above analytes represent those contaminants detected by laboratory analysis and are subsequently considered as COPCs; all are below background or RAG except for Aroclor-1260. Further analysis indicated that residual concentration for Aroclor-1260 meets RAOs.				
100-F-14	Storage Tank	100-FR-2	0.1 m (diameter)	Not Documented	It is unlikely that the original facility's primary use was as a carpenter shop. The slope of the floor from the outer edges of the building, central drain, ramps on the north and south sides of the building, and geophysical survey (conducted prior to confirmatory sampling) indicate that this building may have been a decontamination facility from which rinsate drained to a crib. The concrete pad and vent pipe are still there, and visible. A focused sampling approach was selected for the site. Results of the confirmatory sampling were used to make reclassification decisions for the site in accordance with the TPA-MP-14 process.	No Action	WSRF 2004-127	10/13/04 (confirmatory sampling)	10/13/04 (confirmatory sampling)	None	2.2	Arsenic	1.9 (<BG)	\	\	\
												Boron	1	\	\	\
												Barium	67.5 (<BG)	\	\	\
												Beryllium	0.46 (<BG)	\	\	\
												Chromium (total)	9.1 (<BG)	\	\	\
												Cobalt	7.5 (<BG)	\	\	\
												Copper	14.4 (<BG)	\	\	\
												Lead	3.6 (<BG)	\	\	\
												Manganese	311 (<BG)	\	\	\
												Mercury	0.08 (<BG)	\	\	\
												Molybdenum	0.46	\	\	\
												Nickel	10.4 (<BG)	\	\	\
												Vanadium	59.7 (<BG)	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Zinc	43.4 (<BG)	\	\	\
												Methylene chloride	0.019	\	\	\
												Bis(2-ethylhexyl)-phthalate	0.025	\	\	\
												alpha-BHC	0.0014	\	\	\
												The above analytes represent those contaminants detected by laboratory analysis and are subsequently considered as COPCs. All detected levels meet RAGs.				
100-F-15	French Drain	100-FR-2	0.91 m (diameter)	Not Documented	The drain received condensate that formed inside several large hood ventilation ducts mounted externally on the east wall of the building. Condensate formed during cold weather and ran through 2.5 cm (1-in.) stainless steel lines to the drain. The quantity of waste received is not known. The site was excavated and waste was disposed at ERDF as part of the D&D of the 108-F Laboratory Building in 1999. The site was not sampled to verify cleanup at that time. Site excavation was reported in BHI-01399. No material from the site was disposed at ERDF from the 2001 sampling effort because the French drain was backfilled with the overburden after sampling verification was completed.	Interim Closed Out	CVP-2002-00001	08-Aug-99	07-Feb-02	N/A	4.6	Chromium (total)	15.9	\	15.9	\
												Chromium (hexavalent)	0.45	\	0.45	\
												Pu-238	0.033 U	\	0.0237	\
												Pu-239/240	0.04 U	\	0.0334	\
100-F-16	French Drain	100-FR-1	0.79 m (diameter)	Not Documented	The French drain was constructed of steel pipe, filled with gravel, and covered with a steel lid. The drain extended 18 cm (7 in.) above grade. The drain was adjacent to the south wall of the 108-F Building east loading dock. The dates of operation, and type and quantity of waste are unknown. The site was excavated and waste was disposed at ERDF as part of the D&D of the 108-F Laboratory Building in 1999. The site was not sampled to verify cleanup at that time. Site excavation was reported in BHI-01399. No material from the site was disposed at ERDF from the 2001 sampling effort because the French drain was backfilled with the overburden after sampling verification was completed.	Interim Closed Out	CVP-2002-00001	08-Aug-99	07-Feb-02	N/A	3.3	Pu-238	0.007U (Test Pit)	\	See 100-F-15	\
												Pu-239/240	0.032 (Test Pit)	\	See 100-F-15	\
												Chromium (total)	14 (Test Pit)	\	See 100-F-15	\
												Chromium (hexavalent)	0.51 (Test Pit)	\	See 100-F-15	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
100-F-17	Storage Tank	100-FR-1	45.87 m x 9.75 m x 17.68 m	Not Documented	The site is a four-story steel framed building. The 108-F Building was originally built to be used as a chemical pump house to hold and pump various chemicals needed in reactor water treatment and reactor purging (internal cleansing). It contained many holding and mixing tanks and pumps, along with storage bins for dry materials, conveyor systems, hoppers, and power shovels. Shortly after the F Reactor began operation, it was determined that such treatment would not be required and cooling water treatment could be performed elsewhere in the systems. The 108-F Building was then converted to be used as a biological laboratory where the effects of radiation and contamination on plant and animal life were studied. The chemical storage tanks that were originally located on the west side of the building have been removed. Abandoned equipment and debris are scattered around the southwest corner of the building.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators (RL-TPA-90-0001).	N/A								
100-F-18	Drain/Tile Field	100-FR-1		Not Documented	The site is a condensate drainfield and underground tank or condensate drainpipe, which was not visible at the surface, but was identifiable by a 20 cm (8-in.) -diameter, 91 cm (36-in.) -long steel pipe welded to what appeared to be the top of a 91 cm (36-in.) -diameter steel tank. The upper surface of the "tank" was above grade. No remnants of the drainfield or tank were found.	No Action	WSRF 2004-137	10/18/2004 (confirmatory sampling)	10/18/2004 (confirmatory sampling)	N/A	N/A	Arsenic	1.7 (<BG)	\	\	\
												Barium	38 (<BG)	\	\	\
												Beryllium	0.27 (<BG)	\	\	\
												Boron	0.62	\	\	\
												Chromium (total)	8.5 (<BG)	\	\	\
												Cobalt	4.7 (<BG)	\	\	\
												Copper	26.7	\	\	\
												Lead	2.9 (<BG)	\	\	\
												Manganese	217 (<BG)	\	\	\
												Mercury	0.09 (<BG)	\	\	\
												Molybdenum	0.25	\	\	\
												Nickel	9.5 (<BG)	\	\	\
												Vanadium	31.6 (<BG)	\	\	\
												Zinc	34.5 (<BG)	\	\	\
												Bis(2-ethylhexyl) phthalate	0.02	\	\	\
												Di-n-butylphthalate	0.02	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												The above analytes represent those contaminants detected by laboratory analysis and are subsequently considered as COPCs. All detected levels meet RAGs with the exception of copper (there are no background levels for boron or molybdenum). However, RESRAD modeling for analogous sites indicate it is protective.				
100-F-19	Radioactive Process Sewer	100-FR-1	2214.68 m (length) 3.11 m (diameter)	1945-1965	This site contained the 100-F Reactor cooling water effluent lines, which have been divided into a small pipeline or trench (116-F-2) and three subsites (100-F-19:1, 100-F-19:2, 100F-19:3). The subsites have been remediated and Interim Closed Out. Subsite 19:1 contained a line that was constructed of steel and concrete from the basin to the 1904-F Outfall Structure. Subsite 19:2 consisted of effluent lines that transported 105-F Reactor cooling water from the reactor core to the 107-F Retention Basin. Subsite 19:3 consisted of the effluent line that ran from the 105-F Reactor and the 182-F and 183-F Buildings to the 116-F-1 Lewis Canal. It also included all associated expansion and valve boxes.	Interim Closed Out	See subsites.									
100-F-19:1 (subsite)	Pipelines	100-FR-1	1.5 m (diameter) 250 m (length)	Not Documented	The site includes piping that ran north-northwest from the north side of the 116-F-14 Retention Basin to the 116-F-8 Outfall Structure and also includes a second underground effluent pipeline that extended northwest from the 116-F-14 Retention Basin to a junction box and to the 116-F-6 Outfall Structure.	Interim Closed Out	CVP-2001-00002	07-Aug-01	25-Sep-01	56,335	5	C-14	5.7	2.4 U	2.9	1.7
												Cs-137	0.206	21	0.049	14
												Co-60	0.055 U	14	0.018	6.5
												Eu-152	0.15 U	330	0.044	150
												Eu-154	0.19 U	27	0.064	13
												Eu-155	0.13 U	0.79 U	0.047	0.23
												Ni-63	0.389 U	350	-0.024	170
												Sr-90	0.334 U	4.9	0.043	2.7
												Chromium (hexavalent)	0.66	5.6	0.66	5.6
100-F-19:2 (subsite)	Pipelines	100-FR-1	106 cm (diameter) 635 m (length); 152 cm diameter 283 m (length); 105 cm (diameter) 283 m (length)	Not Documented	The 100-F-19:2 pipelines are a subsite of the collective 100-F-19 Effluent Pipeline System. The waste site is composed of three pipelines exiting the reactor facility toward the east to the 107-F Retention Basin (116-F-14 waste site). The pipeline carried cooling waste by gravity flow from the reactor core to the 107-F Retention Basin.	Interim Closed Out	CVP-2001-00003	01-Aug-01	21-Jan-03	39,347	5	Am-241	0.078 U	0.39 U	0.089	0.0476
												Ba-133	0.053 U	0.089 U	\	\
												C-14	0.990 U	2.06	0.147	0.526
												Cs-137	0.36	5.21	0.121	3.48
												Co-60	0.058 U	1.16	0.0185	0.581
												Eu-152	0.711	17.1	0.164	8.64
												Eu-154	0.20 U	1.66	0.0623	0.871
												Eu-155	0.140 U	0.35 U	0.0535	0.121

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Ni-63	14.6 B	340	6.47	152
												Pu-238	0.032 U	0	0.175	0.00301
												Pu-239/240	0.036 U	0.181	\	\
												Sr-90	0.177 U	1.53	0.0288	0.873
												U-233/234	0.588	0.601	\	\
												U-238	0.767	0.592	\	\
												Tritium	0.00963 U	0.000313	-0.0646	-0.0234
												Barium	120	66	101	65
												Chromium (hexavalent)	0.48	1.1	0.48	1.1
												Lead	4.8	4.1	4.7	4.1
												Mercury	0.051	0.011B	0.016	0.017
100-F-19:3 (subsite)	Pipelines	100-FR-1	1.2 m (diameter)	Not Documented	The site includes sections of effluent pipelines located north of the reactor running west from the 182-F Reservoir and the 126-F-12 (183-F) Clearwell to the 116-F-1 Lewis Canal. This subsite also includes piping running in a north-south direction between the 182-F Reservoir and the 126-F-12 Clearwell.	Interim Closed Out	CVP-2001-00002	See 100-F-19:1								
100-F-2	Laboratory	100-FR-2	24.38 m x 9.45 m	1952-1970	The site was a garden plot that was established to study the behavior of plants grown in soil containing Cs-137 and Sr-90, under controlled conditions of soil tillage, irrigation, cropping, and abandonment. The waste was contaminated soil. Approximately 39 µCi of Sr-90 and 120 µCi of Cs-137 were added to the soil for botany experiments.	Interim Closed Out	CVP-2001-00001	05-Dec-01	13-Feb-02	1,269	1.6	Cs-137	0.35	\	0.217	\
												Sr-90	0.222	\	0.128	\
100-F-20	Trench	100-FR-2	22.86 m x 6.10 m x 2.4 m	1962	The site consists of two earthen pits or trenches. The trenches are believed to have been used to dispose of both radioactive and nonradioactive material from the EAF. The Burial Ground ROD reports that the northern trench may contain non-radioactive animal farm wastes, including hardware, lumber, and soft materials (EPA/ROD/R10-00/121). The southern pit may have received radioactively contaminated animal feces and pen sweepings.	Interim Closed Out	CVP-2006-00009	05-Dec-05	16-Aug-06	11,953	4.3	Co-60	0.053 U	\	0.053 (ND)	\
												Cs-137	0.051 U	\	0.024 (ND)	\
												Ni-63	1.29 U	\	-0.192 (ND)	\
												Pu-239/240	0.047 U	\	0.025 (ND)	\
												Sr-90	0.074 U	\	0.075(ND)	\
												Pb	31.2	\	24.1	
												Lead exceeded RAGs but RESRAD modeling indicated it was protective of the environment.				\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
100-F-21	Unplanned Release	100-FR-1	Not Documented	Not Documented	The site consists of grounds within the 100-F Area exclusion area that are not part of other waste sites.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
100-F-23	French Drain	100-FR-1	Not Documented	1945-1976	The French drain may have received liquid waste from the 141-C Isotope Study Facility/Animal Barn, which housed plant and animal research on the effects of ionizing radiation. The site may have received liquid wastes from animal pens and 141-C Building Research Laboratories. It is also likely that the French drain received stormwater runoff from the loading dock.	Interim Closed Out	CVP-2003-00011	12-Apr-03	16-Apr-03	458	3.2	C-14	1.79 U	\	1.5	\
												Cs-137	0.099 U	\	0.0344	\
												Co-60	0.036 U	\	0.0156	\
												Eu-152	0.082 U	\	0.0363	\
												Sr-90	0.0109 U	\	0.0136	\
												Chromium (hexavalent)	0.46 U	\	0.46	\
100-F-24	French Drain	100-FR-1	Not Documented	Not Documented	The 100-F-24 site was a French drain associated with the 145-F Animal Monitoring Laboratory, which houses animal research on the effect of ionization radiation. The French drain is believed to have received liquid wastes from 145-F Building Research Laboratories.	Interim Closed Out	CVP-2003-00012	12-Apr-03	16-Apr-03	259	2.7	C-14	0.943 U	\	0.611	\
												Cs-137	0.053 U	\	0.0288	\
												Co-60	0.039 U	\	0.0172	\
												Eu-152	0.089 U	\	0.0385	\
												Sr-90	0.086 U	\	0.0807	\
												Chromium (hexavalent)	0.44 U	\	0.44	\
100-F-25	French Drain	100-FR-1	1.52 m (diameter)	1956-1975	The 100-F-25 Waste Site excavation footprint includes the 100-F-25 French Drain, 146-FR Drywells, and the UPR-100-F-3 Mercury Spills. The waste site is associated with research on the effects of ionizing radiation on fish. The French drain is believed to have received liquid wastes from 146-F and 146-FR Research Laboratories and ponds.	Interim Closed Out	CVP-2003-00010	12-Apr-03	16-April-03	809	4	C-14	0.148 U	\	0.548	\
												Cs-137	0.068 U	\	0.0486	\
												Co-60	0.042 U	\	0.02	\
												Eu-152	0.134	\	0.103	\
												Eu-154	0.14 U	\	0.0652	\
												Ni-63	4.6	\	4.35	\
												Sr-90	0.167 U	\	0.0536	\
												Mercury	0.14	\	0.092	\
												Chromium (hexavalent)	0.43 U	\	0.43	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
100-F-26	Process Sewer	100-FR-1	Not Documented	1945-1965	The site encompasses the upstream (pre-reactor) process sewers for the 100-F Area, including all underground water lines used to transport reactor cooling water between the water treatment facilities and the 105-F Reactor Building. These include potentially contaminated underground lines running between buildings and those that run to drainage facilities. The waste consists of contaminated pipelines made of various materials (i.e., steel piping, concrete, and soil). Chemical additives to the reactor cooling water included aluminum sulfate (alum) with excess hydrated calcium oxide, sulfuric acid, chlorine, and sodium dichromate. Water pH was maintained at about 7.5, and the free chlorine residual was approximately 0.2 mg/L.	Accepted	EPA/ROD/R10-99/039	N/A								
100-F-28	Septic Tank	100-FR-2	Not Documented	Not Documented	The unit would have received sanitary sewage. Because the unit appears to have supported only one building and that building is not near any contaminated facilities, it is highly unlikely that it received any radiological contamination. This septic system was apparently removed when the larger area around it was excavated to a 3 to 5 m (10- to 15-ft) depth many years ago. The site was included in EPA/ROD/R10-99/039, but without a reason provided. It serviced an isolated office building in the north part of the 100-F Area.	Rejected	WSRF 2001-030	N/A								
100-F-29	Radioactive Process Sewer	100-FR-1	220 cm, 15 cm, 8 cm diameter pipelines	1945-1976	The site consisted of contaminated pipelines that existed at the 100-F Area EAF site. The waste is mixed (chemically and radiologically) contaminated piping (concrete, steel, and vitrified clay) and contaminated soil. Several radioisotopes were used in varying concentrations. These included iodine-131, Sr-90, Cs-137, and isotopes of plutonium and uranium. All such research generated contaminated urine and feces. Other wastes resulted from cleaning contaminated pens and cages with water.	Interim Closed Out	CVP-2001-00003	See 100-F-19:2								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
100-F-30	French Drain	100-FR-1	Not Documented	Not Documented	The site was a drywell on the south side of the 144-F Building. During a site investigation on January 2, 1997, no evidence of a drywell was visible. The dry well received rainwater from the roof of the 144-F Building.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
100-F-31	Septic Tank	100-FR-1	2.60 x 1.10	1977	The site was a septic system, drain field, and associated piping that supported the 144-F Building. The facility included laboratories that performed radiological studies on various species of animals. The septic system treated and disposed of human and animal waste.	Interim Closed Out	WSRF 2006-033	14-Oct-04	17-May-06	350 BCM	3	Arsenic	6.2	\	5	\
												Barium	96.3	\	86.9	\
												Beryllium	0.2	\	0.17	\
												Boron	4	\	2.7	\
												Cadmium	0.86	\	0.66	\
												Chromium (total)	10.7	\	9.3	\
												Chromium (hexavalent)	0.55	\	0.31	\
												Cobalt	4.8	\	4.5	\
												Copper	16.5	\	13.9	\
												Lead	12.9	\	13	\
												Manganese	281	\	230	\
												Nickel	11.1	\	10	\
												Vanadium	37.5	\	33.6	\
												Zinc	66.2	\	47.2	\
												Benzo(a) anthracene	0.054	\	0.13	\
												Benzo(a)pyrene	0.046	\	0.15	\
												Benzo(b) fluoranthene	0.042	\	0.15	\
												Benzo(g,h,i) perylene	0.028	\	\	\
												Benzo(k) fluoranthene	0.048	\	0.13	\
												Chrysene	0.065	\	0.11	\
												Fluoranthene	0.088	\	0.17	\
												Indeno(1,2,3-cd)pyrene	0.025	\	\	\
												Phenanthrene	0.034	\	\	\
												Pyrene	0.12	\	0.18	\
												Aroclor-1254	0.03	\	0.016	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
												Lead exceeded RAGs but RESRAD modeling indicated it was protective of the environment.				
100-F-32	Storage Tank	100-FR-1	10.7 m (length) 2.4 m (diameter) (3 tanks)	Not Documented	The site is three underground fuel oil storage tanks. Each tank had a capacity of 94,625 L (25,000 gal). Pipelines ran to the 1717-F Building (Combined Shops) though a pump pit immediately east of the tanks.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
100-F-33	Unplanned Release	100-FR-1	3.35 m x 2.90 m (small pond) 15.54 m x 1.83 m (large pond) 9.14 m (diameter circular pond)	1945-1976	The 100-F-33 waste site, also referred to as the 146-F Aquatic Biology Fishponds and the fish laboratory, was designed to conduct tests on fish. Originally, there were six divided small ponds, one circular pond, and one rectangular pond. The site is an area where unplanned releases likely occurred from the fishponds. The ponds were removed. During site walkdowns, there was no visual evidence remaining where they were originally located.	Interim Closed Out	WSRF 2006-021	05-Aug-05	24-Jan-06	2,024	2.5	Arsenic	7.3	\	4.5 (<BG)	\
												Barium	75.4	\	68.3 (<BG)	\
												Beryllium	0.06	\	0.03 (<BG)	\
												Boron	1.9	\	1.7	\
												Cadmium	0.14 (<BG)	\	\	\
												Chromium (total)	10.2	\	9.5 (<BG)	\
												Cobalt	6.1	\	5.5 (<BG)	\
												Copper	13.5	\	11.6 (<BG)	\
												Lead	12.9	\	9.9 (<BG)	\
												Manganese	287	\	258 (<BG)	\
												Mercury	0.05 (<BG)	\	\	\
												Molybdenum	0.41	\	0.23	\
												Nickel	11.2	\	10.3 (<BG)	\
												Vanadium	39.7	\	33.8 (<BG)	\
												Zinc	147	\	69	\
												Aroclor-1254	0.26	\	0.36	\
												2-Methylnaph-thalene	0.031 J	\	\	\
												Di-n-butylph-thalate	0.03 J	\	\	\
												Naphthalene	0.022 J	\	\	\
												Phenol	0.019 J	\	\	\
												Copper, lead, zinc, and Aroclor-1254 exceeded RAGs but RESRAD modeling indicated they were protective of the environment.				
100-F-34	French Drain	100-FR-1	0.64 m (diameter)	Not Documented	It was not known what purpose this site served. The pipeline that connected the French drain to a facility has not been located on any of the numerous drawings that have been researched for this area.	Interim Closed Out	CVP-2001-00002	See 100-F-19:1								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
100-F-35	Unplanned Release	100-FR-2	4.70 m x 3.90 m	Not Documented	An area of radiologically contaminated soil, reading 60,000 dpm was identified within the 105-F Exclusion Area. The ground contamination was the result of a large container placed in this area to hold contaminated soil removed from the 116-F-4 Pluto Crib. Soil samples from the 116-F-4 Crib identified Sr-90 and Cs-137 as the major contaminants.	Interim Closed Out	CVP-2002-00007	01-Oct-02	07-Jan-03	75.4	0.9	Am-241	1.83	\	1.4	\
												Cs-137	2.56	\	2.08	\
												Co-60	4.2 U	\	0.0185	\
												Eu-152	1.2 U	\	0.0549	\
												Eu-154	1.3	\	0.0615	\
												Pu-239/240	1.68	\	1.56	\
												Sr-90	0.638	\	0.49	\
												U-233/234	0.913	\	0.782	\
												U-238	0.806	\	0.721	\
												Chromium (hexavalent)	0.52	\	0.52	\
100-F-36	Laboratory	100-FR-1	45.87 m x 9.75 m	1944-1973	The site consisted of a building that was demolished in August 1999. It was a chemical makeup facility that supported the 105-F Reactor. In 1948, the building was converted to a biological laboratory to test the effects of radiation on animals and biological systems. Biological experiments used a variety of hazardous materials and radiological isotopes including plutonium. From 1983 through 1984, the first floor of the 108-F Building was used for office space. Between 1984 and 1996, the facility was maintained in a safe condition through the S&M Programs of the site's contractors. Most of the building debris and foundations were removed.	No Action	WSRF 2007-002	1999 (demolition)	12/5/2006 (confirmatory sampling)	N/A	2.1 m (depth of confirmatory sampling).	U-233/234	0.687 (<BG)	\	0 <BG)	\
												U-238	1.01 (<BG)	\	0 <BG)	\
												Arsenic	1.8 (<BG)	\	1.7	\
												Barium	33.5 (<BG)	\	32.5	\
												Beryllium	0.19 (<BG)	\	0.19	\
												Chromium (total)	6.9 (<BG)	\	6.6	\
												Chromium (hexavalent)	0.32	\	\	\
												Cobalt	3.8 (<BG)	\	3.7	\
												Copper	10.2 (<BG)	\	10	\
												Lead	2.0 (<BG)	\	2.1	\
												Manganese	195 (<BG)	\	194	\
												Nickel	8.1 (<BG)	\	8	\
												Vanadium	27.7 (<BG)	\	27.3	\
												Zinc	25.3 (<BG)	\	25.2	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL Deep[b]
100-F-37	French Drain	100-FR-1	Not Documented	Not Documented	The site consisted of an abandoned French drain. This French drain was discovered when a trench for electrical conduit was being dug in November 2000. The analytical results showed a high level of lead at 214 ppm.	No Action	WSRF 2004-095	3-Nov-00	3-Nov-00	N/A	>1	Arsenic	17.3 <BG	\	\	\
												Barium	508	\	\	\
												Cadmium	0.71 <BG	\	\	\
												Chromium (total)	18.1 <BG	\	\	\
												Lead	214	\	\	\
												Mercury	0.07 <BG	\	\	\
												Bis(2-ethylhexyl) phthalate	0.34	\	\	\
												Results for all COPCs are less than background or RAGs except for barium and lead, which exceed groundwater protection lookup values. RESAD modeling indicates that they are protective of the environment.				
100-F-38	Unplanned Release - Stained Soil Site	100-FR-1	1.58 m x 1.33 m	Not Documented	The site was an area of stained soil discovered in November 2000 while excavating a trench for the placement of electrical conduit. During trench excavation, some yellow soil was encountered. Following the collection of the soil sample and the placement of the electrical conduit in the trench, the excavated soil was returned to the trench as backfill. The origin of this yellow soil, or its potential association with any other structures or operations in the vicinity of this area, has not been confirmed. However, based on observations at the time of discovery, the 100-F-38 site appears to be an isolated area associated with the disposal of yellow paint.	Interim Closed Out	WSRF 2004-093	15-Sep-05	02-Nov-05	5.4	0.9	Ra-226	0.957	\	\	\
												Arsenic	2.4 (<BG)	\	\	\
												Barium	388	\	\	\
												Beryllium	0.434 (<BG)	\	\	\
												Boron	23.5	\	\	\
												Cadmium	0.117 (<BG)	\	\	\
												Chromium (hexavalent)	1.9	\	\	\
												Chromium (total)	14.5 (<BG)	\	\	\
												Cobalt	6.3 (<BG)	\	\	\
												Copper	18 (<BG)	\	\	\
												Lead	38.4	\	\	\
												Manganese	291 (<BG)	\	\	\
												Molybdenum	0.51	\	\	\
												Nickel	10.8 (<BG)	\	\	\
												Vanadium	44.1 (<BG)	\	\	\
												Zinc	36.4 (<BG)	\	\	\
												Aroclor-1260	0.032	\	\	\
												The above analytes represent those contaminants detected by laboratory analysis and are subsequently considered as COPCs; all are below background or RAG except for barium, lead, and Aroclor-1260. RESRAD analysis indicated that residual concentrations for these contaminants will not reach groundwater.				

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
100-F-39	Radioactive Process Sewer	100-FR-1	1.07 m (diameter)	Not Documented	This site consists of the river effluent pipelines (river lines) that extend from the 1904-F Outfall (116-F-8) in the 100-F Area into the main channel of the Columbia River.	Accepted	EPA/ROD/R10-99/039	N/A								
100-F-4	French Drain	100-FR-1	0.30 m (diameter)	Not Documented	The French drain was constructed of vitrified clay pipe, or similar material and was filled with gravel. A 1.3 cm (0.5-in.) steel pipe entered the drain from the 108-F Building. Documentation suggests that the drain was likely removed as part of the layback zone of the 108-F Building excavation. The site was excavated and waste was disposed at ERDF as part of the D&D of the 108-F Laboratory Building in 1999. The site was not sampled to verify cleanup at that time. Site excavation was reported in BHI-01399. No material from the site was disposed at ERDF from the 2001 sampling effort because the French drain was backfilled with the overburden after sampling verification was completed.	Interim Closed Out	CVP-2002-00001	08-Aug-99	7-Feb-02	None	4.7	Pu-238	0.017U	\	See 100-F-15	\
												Pu-239/240	0.052	\	See 100-F-15	\
												Chromium (total)	16	\	See 100-F-15	\
												Chromium (hexavalent)	3.2	\	See 100-F-15	\
100-F-40	Surface Impoundment	100-FR-1	Not Documented	Not Documented	This site was a pair of impoundments and the associated ditches, which are no longer visible in the field. Samples collected in April 2001 determined the surface ponds held only uncontaminated animal waste resulting from pen cleaning.	Rejected	WSRF 2001-095	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
100-F-41	Product Piping	100-FR-1	Not Documented	1944-1964	The site encompasses the clean water pipelines for the 100-F Area, including underground pipelines used to transport raw, fire, export, and sanitary water from the river pump house to the water treatment facilities and to 100-F Area facilities and fire hydrants. Four additional pipelines were identified as being associated with the 100-F-41 Service Water Pipelines site. These pipelines are subsites of the 100-F-41 site: Subsite 100-F-41:1 Discovery Pipeline Between 182-F and 183-F; Subsite 100-F-41:2 Discovery Pipeline at 190-F; Subsite 100-F-41:3 Discovery Pipeline Southeast of 1704-F; and Subsite 100-F-41:4 Discovery Pipeline on West Side of 115-F. The 100-F-41 service water pipelines carried only raw river water and filtered/treated water from the 183-F Filter Plant. Based on the absence of potential chemical or radionuclide contamination associated with service water pipelines, the 100-F-41 site (including subsites 1 through 4) has been rejected from consideration as a waste site.	Rejected	WSRF 2006-064	N/A								
100-F-42	Spillway	100-FR-1	61.0 m x 4.27 m x 2.90 m	1945-1965	The site consisted of a reinforced-concrete spillway (also referred to as a flume). The spillway extended from the 116-F-8 Outfall to the Columbia River shoreline and into the river. The spillway was an alternate discharge point for the 116-F-8 Outfall Structure. It was planned to be used only if the 100-F-39 river effluent pipelines were blocked, damaged, or undergoing maintenance. There is no corroborated physical or historical evidence that the spillway was ever used. Sufficient evidence existed to warrant remedial action at the 100-F-42 waste site during remediation of the 116-F-8 waste site, and both waste sites were remediated and evaluated as a single unit.	Interim Closed Out	WSRF 2006-045 and Attachment to WSRF 2006-038.	31-Aug-04	26-Feb-06	4,900	8	Cs-137	0.098 U	0.273	0.044 (ND)	0.249

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
												Co-60	0.099 U	0.098 U	0.047 (ND)	0.081 (ND)
												Eu-152	0.22 U	2.1	0.1 (ND)	2.37
												Eu-154	0.32 U	0.45 U	0.14 (ND)	0.22 (ND)
												Eu-155	0.26 U	0.33 U	0.12 (ND)	0.16 (ND)
												Chromium (hexavalent)	0.35	0.22 U	0.27	0.22 (ND)
100-F-43	Spillway	100-FR-1	38.10 m x 4.88 m x 2.44 m	Not Documented	The 100-F-43 spillway (also referred to as a flume) was constructed of reinforced-concrete, and extended from the 116-F-16 PNNL Outfall to the Columbia River shoreline and into the river. The waste would be from the spillway that received animal sewage, 107-F Retention Basin water from fish studies, and low-level contamination resulting from various 100-F EAF projects. Also, the waste would be potentially contaminated soil that may have been associated with spills or overflows from the spillway. Sufficient evidence existed to warrant remedial action at the 100-F-43 waste site during remediation of the 116-F-16 waste site, and both waste sites were remediated and evaluated as a single unit.	Interim Closed Out	WSRF 2006-046 and Attachment to WSRF 2006-039.	31-Aug-04	15-Feb-06	2,090	<4.6	Cs-137	0.013 U	\	0.062 (ND)	\
												Pu-239/240	0.065 U	\	0.043 (ND)	\
												Sr-90	0.058 U	\	0.003 (ND)	\
												Chromium (hexavalent)	0.42	\	0.39	\
												Lead	5.3	\	4.7	\
100-F-44	Miscellaneous Pipelines	100-FR-1	Unknown	Not Documented	The site consists of a compilation of pipeline segments not previously addressed in any closure documents. The various pipelines may require remedial action. See the subsite summaries for specific information.	Accepted--see subsites	OSR-2005-0001	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
100-F-44:1 (subsite)	Process Sewer	100-FR-1	Not Documented	Not Documented	The 100-F-44:1 pipeline site was discovered during confirmatory sampling at Test Pit 5 of the 100-F-26:l pipelines site. The Test Pit contained a junction box with two 76 cm (30-in.) reinforced-concrete pipes and a previously unidentified 20 cm (8-in.) carbon steel pipe. As documented in the Attachment to WSRF 2005-008, the process sewer that joined the 182-FA discharge pipe at the junction box was sampled as part of confirmatory sampling for the 100-F-26:1 pipelines site. Evaluation of the confirmatory sample results for 100-F-26:1 satisfied the RAOs and the site was reclassified to No Action. The water carried by the 100-F-44:1 pipeline was essentially the same water carried by the 100-F-26:1 pipeline; therefore, no remedial action for the 100-F-44:1 subsite was needed.	No Action	WSRF 2007-005	N/A								
100-F-44:10 (subsite)	Process Sewer	100-FR-1	20	Not Documented	The subsite consists of two 20.3 cm (8 in.) diameter sewer pipeline segments exiting the 141-C Building. Documentation in the CVP-2001-0003 stated that pipelines excavated on March 22, 2002, extended from just east of the former 141-C Building to the former 141-N waste lift station. In August 2005, during the 141-C Building remediation, exploratory trenches were dug to confirm that the sewer lines formerly servicing the 141-C Building had been removed during previous D&D activities. No sewer lines were located by these excavations and field instrumentation did not detect any beta/gamma or alpha activity above background levels. There was no evidence to support the existence of the pipe segments in the vicinity of the 141-C Building. Therefore, the subsite has been reclassified to rejected from consideration as a waste site.	Rejected	WSRF 2007-011	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
100-F-44:3 (subsite)	Process Sewer	100-FR-1	Not Documented	Not Documented	The 100-F-44:3 Subsite was identified as a 0.3 m (1-ft) steel or cast iron pipeline. The subsite was originally identified by visual observation during confirmatory sampling within the manhole at 100-F-26:10 Test Pit 2. However, it has been determined through the excavation of the 100-F-26:10 pipelines in 2007 that the visual observation of the 100-F-44:3, 0.3 m (1 ft) diameter steel or cast iron pipe was erroneous. The entire manhole was removed during the 100-F-26:10 remediation, along with a quantity of the soil beneath and surrounding the manhole. No other pipeline was encountered during the excavation. There was no evidence to support the existence of the 100-F-44:3, 0.3 m (1 ft) diameter steel or cast iron pipe within the manhole at the 100-F-26:10 Test Pit 2. Therefore, 100-F-44:3 was reclassified as rejected from consideration as a waste site.	Rejected	WSRF 2007-010	N/A								
100-F-45	Radioactive Process Sewer	100-FR-1	1.067 m (diameter)	Not Documented	The site consists of a piece of pipeline that was buried in the river bank. Based on information that was accidentally discovered, it is believed to be part of the pipeline that floated loose and broke off the 100-F Area river effluent pipeline. Chemically and radiologically contaminated liquids were routinely discharged through these pipelines. Contaminated residue may have remained in the pipelines after its burial.	Accepted	OSR-2005-0001	N/A								
100-F-46	French Drain	100-FR-1	1.0 m x 3.05 m	1944-1965	The site may contain contaminated soil from condensate entering the French drain. The condensate from the 116-F Stack potentially contained the same contaminants of concern identified for the 116-F Stack during the characterization sampling performed for the allowable residual contamination level evaluation completed in 1985.	Accepted	OSR-2005-0001	N/A								
100-F-47	Electrical Substation	100-FR-1	137.20 m x 92.40 m (substation) 24.40 m x 9.10 m (switch house) 21.90 m x 3.40 m (cable pit)	1945-1965	The site is any contaminated soil and remaining underground equipment associated with the former 151-F Substation.	Accepted	OSR-2005-0001	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
100-F-48	Dumping Area	100-FR-1	153.0 m x 86.0 m	Not Documented	The exact content of potential waste located in the ash pit is unknown, but is suspected to be demolition and inert debris from decommissioning and demolition of site facilities. Asbestos-containing materials may be present at the site.	Accepted	Not Documented	N/A								
100-F-49	Foundation	100-FR-1	16.31 m x 14.63 m x 5.49 m	1945-present (left in place)	The site is the remaining components of the 1716-F Maintenance Garage, including the foundation, lubrication pit, and contaminated drain(s). At a minimum, contaminants of concern would include PCBs and TPH.	Accepted	OSR-2005-0001	N/A								
100-F-5	French Drain	100-FR-1	1.22 m (diameter)	Not Documented	The site is a French drain (drywell). The purpose of the site was to receive boiler steam condensate from blowdown valves. Steam condensate is nondangerous and nonradioactive.	Rejected	WSRF 97-001	N/A								
100-F-50	French Drain	100-FR-2	1.0 m (diameter)	Not Documented	The site is a stormwater diversion culvert located southeast of the 116-F-6 Disposal Trench between two railroad grades. It consists of a circular concrete basin and a steel culvert (pipe). The basin is partially filled with sediment, rocks, and vegetation; the steel culvert is partially filled with soil and rocks.	No Action	WSRF 2007-001	11/19/2007 (confirmatory sampling)	11/19/2007 (confirmatory sampling)	N/A	0.5	Cs-137	0.912	\	\	\
												Eu-152	0.365	\	\	\
												Sr-90	0.872	\	\	\
												Arsenic	2.2 <BG	\	\	\
												Barium	66.2 <BG	\	\	\
												Beryllium	0.81 <BG	\	\	\
												Boron	2.6	\	\	\
												Chromium (total)	7.6 <BG	\	\	\
												Cobalt	6.4 <BG	\	\	\
												Copper	12.8 <BG	\	\	\
												Lead	6.2 <BG	\	\	\
												Manganese	310 <BG	\	\	\
												Nickel	9.7 <BG	\	\	\
												Vanadium	53.1 <BG	\	\	\
												Zinc	47.2 <BG	\	\	\
												Benzo(a) anthracene	0.019	\	\	\
												Benzo(a)pyrene	0.023	\	\	\
												Benzo(b) fluoranthene	0.055	\	\	\
												Benzo(k) fluoranthene	0.022	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Bis(2-ethylhexyl) phthalate	0.45	\	\	\
												Chrysene	0.044	\	\	\
												Di-n-butylph-thalate	0.026	\	\	\
												Fluoranthene	0.038	\	\	\
												Pyrene	0.04	\	\	\
												Dalapon	0.031	\	\	\
												DDE	0.0014	\	\	\
												Aroclor-1254	0.015	\	\	\
												COPCs represent those contaminants present at concentrations exceeding laboratory detection limits. All concentrations are below RAGS except for bis(2-ethylhexyl)phthalate; however, RESRAD modeling indicates the concentration is protective of groundwater.				
100-F-51	Unplanned Release	100-FR-1	6.10 m x 4.88 m	1945	The site is the soil under and around the former 146-F Fish Laboratory. Liquids that were chemically and radiologically contaminated were routinely used in the building. These liquids were contained in large, open-topped fish troughs and head tanks, which overflowed and drained onto the sloped concrete floor of the building into a centrally located concrete trench that drained to the process sewer, that in turn drained to the 147-F Pump House pit. Sometime after 1951, the building was removed, and a Butler building warehouse (142 F) was constructed on the southern portion of the original concrete pad. Although this pad was not observed during a 2005 walkdown of the area, it is not known if or when the pad may have been removed.	Accepted	OSR-2005-0001	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
100-F-52	Unplanned Release	100-FR-1	35.05 m x 24.99 m	1952-1967	The site is the soil under and around the former 146-FR Radioecology and Aquatic Biology Laboratory. Completed in 1952, the 146-FR Radioecology and Aquatic Biology Laboratory functionally replaced the 146-F Fish Laboratory and associated outdoor ponds. Liquids that were chemically and radiologically contaminated were routinely used in the building. These liquids were contained in large, open-topped fish troughs and tanks. The facility operated for at least 20 years.	No Action	WSRF 2008-022	11/28/2007 (confirmatory sampling)	2/20/2008 (confirma-tory sampling)	N/A	1.3 (sampling depth)	U-233/234	1.34	\	\	\
												U-238	1.02 (<BG)	\	\	\
												Antimony	3.3 (<BG)	\	\	\
												Arsenic	15.7	\	\	\
												Barium	67.6 (<BG)	\	\	\
												Beryllium	0.49 (<BG)	\	\	\
												Boron	1.5	\	\	\
												Cadmium	5 (pipe scale)	\	\	\
												Chromium (total)	70 (pipe scale)	\	\	\
												Cobalt	9.7 (<BG) (pipe scale)	\	\	\
												Copper	59.8 (pipe scale)	\	\	\
												Chromium (hexavalent)	1.1 (trench)	\	\	\
												Lead	5.2 (<BG) (trench)	\	\	\
												Manganese	1760 (pipe scale)	\	\	\
												Mercury	0.06 (<BG) (pipe scale)	\	\	\
												Molybdenum	15.2 (pipe scale)	\	\	\
												Nickel	50.5 (pipe scale)	\	\	\
												Silver	0.75 (pipe scale)	\	\	\
												Vanadium	35.1 (<BG) (trench)	\	\	\
												Zinc	244 (pipe scale)	\	\	\
												Benzo(a)pyrene	0.019 (trench)	\	\	\
												Bis(2-ethylhexyl) phthalate	0.24 (pipe scale)	\	\	\
												Di-n-butylph-thalate	0.33 (trench)	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
												COPCs represent those contaminants present at concentrations exceeding laboratory detection limits. RAGs were exceeded for cadmium, chromium, copper, manganese, molybdenum, nickel, silver, and zinc. Data were not collected on the vertical extent of residual contamination; however, RESRAD modeling indicates concentrations are protective of the environment. Max concentrations are a combination of trench samples and pipe scale as indicated in parentheses.				
100-F-53	Septic Tank	100-FR-1	Not Documented	1944	The site is a potential septic system that included a drainfield and related piping. Historical research produced an early (1944) pre-construction drawing that depicts what appears to be an undocumented septic system or drain field directly east of the 108-F Building footprint. No clear evidence was found of a septic tank, septic line, or drain field. Confirmatory sampling results indicated that the residual concentrations of COPCs at this site do not exceed the RAOs for direct exposure, groundwater protection, and river protection.	No Action	WSRF 2008-019	12/04/2007 (confirmatory sampling)	02/19/2008 (confirmatory sampling)	N/A	2.4	Cs-137	0.58	\	\	\
												U-233/234	0.874 (<BG)	\	\	\
												U-238	0.938 (<BG)	\	\	\
												Antimony	1.2 (<BG)	\	\	\
												Arsenic	3.0 (<BG)	\	\	\
												Barium	75.2 (<BG)	\	\	\
												Beryllium	0.68 (<BG)	\	\	\
												Boron	3.1	\	\	\
												Cadmium	0.13 (<BG)	\	\	\
												Chromium (total)	12.9 (<BG)	\	\	\
												Cobalt	5.79 (<BG)	\	\	\
												Copper	13.3 (<BG)	\	\	\
												Lead	21.2	\	\	\
												Manganese	413 (<BG)	\	\	\
												Mercury	1.2	\	\	\
												Molybdenum	1.1	\	\	\
												Nickel	10.4 (<BG)	\	\	\
												Vanadium	54.4 (<BG)	\	\	\
												Zinc	112	\	\	\
												Aroclor-1254	0.0091	\	\	\
												Aroclor-1260	0.010	\	\	\
												Dichlorodiphenyl-trichloroethane (DDT)	0.0023	\	\	\
												Benzo(a) anthracene	0.140	\	\	\
												Benzo(a)pyrene	0.100	\	\	\
												Benzo(b) fluoranthene	0.092	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Benzo(g,h,i) perylene	0.068	\	\	\
												Benzo(k) fluoranthene	0.100	\	\	\
												Bis(2-ethylhexyl) phthalate	0.200	\	\	\
												Chrysene	0.160	\	\	\
												Dibenz(a,h) anthracene	0.034	\	\	\
												Fluoranthene	0.170	\	\	\
												Indeno(1,2,3-cd)pyrene	0.059	\	\	\
												Phenanthrene	0.047	\	\	\
												Pyrene	0.260	\	\	\
100-F-54	Unplanned Release	100-FR-1	1,500 m^2	1952-1967	The 100-F-54 site is soil associated with the former pastures for holding domestic farm animals used in experimental toxicology studies. Evaluation of historical information resulted in identification of the EAF pastures as having potential for residual soil contamination due to excrement from experimental animals. Some of these areas were used for stockpiling soil associated with the 100-F Area RA excavations, were extensively disturbed during remediation activities, and were subsequently surveyed and/or sampled to demonstrate no residual radiological activity.	No Action	WSRF 2008-015	11/19/2007 (confirmatory sampling)	11/19/2007 (confirmatory sampling)	N/A	0.152	Cs-137	0.673	\	0.254	\
												Eu-152	0.598	\	0.234	\
100-F-55	Unplanned Release	100-FR-1	0.3 m (depth)	Not Documented	During activities to search for and characterize the 1607-F7 Septic System, a trench was excavated across part of the site. The trench exposed an ash layer nearby but outside the 1607-F7 footprint. The ash was found to be above cleanup limits for sodium dichromate. The ash layer is unrelated to the 1607-F7 Septic System.	Accepted	OSR-2005-0001	N/A								
100-F-56	Dumping Area	100-FR-1	Not Documented	1944	The site is miscellaneous discarded/abandoned materials. Various sizes and forms of hazardous (CERCLA) and/or dangerous (MTCA) surface debris waste materials were left during the construction, operation, D&D, and RA activities at the 100-F Area.	Accepted	OSR-2005-0001	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
100-F-57	Foundation	100-FR-1	50.0 m x 140.0 m; 60.0 m x 25.0 m (190-F Annex)	1945-1965	The 100-F-57 site consists of the remaining below-grade pump room facilities and foundation of the former 190-F Process Water Pump House. The 100-F Area water treatment facilities provided large volumes of high-quality cooling water to the 105-F Reactor. The 190-F Process Water Pump House was the final in a series of facilities that treated the raw river water before it was pumped to the 105-F Reactor.	Accepted	OSR-2005-0001	N/A								
100-F-58	Dumping Area	100-FR-1	Not Documented	1944	This site is miscellaneous potentially asbestos-containing waste that has been discarded/ abandoned in the 100-F Area. Various sizes and forms of hazardous (CERCLA) and/or dangerous (MTCA) surface debris waste materials were left during the construction, operation, D&D, and RA activities at the 100-F Area.	Discovery	Not Documented	N/A								
100-F-59	Burn Pit	100-FR-1	Not Documented	1945-1965	The 100-F-59 is a non-radiological waste site created from two riparian areas known to contain contaminants above soil RAGs. The first area was originally part of the 128-F-2 Burning Pit waste site located adjacent to the Columbia River. This portion of the site was remediated to an elevation below the OHWM of the river but sampling shows that metal contamination in excess of soil RAGs was present.	Accepted	OSR-2005-0001	N/A								
100-F-6	Storage Tank	100-FR-1	Not Documented	1945	The site is the 1716-FA Automotive Repair Shop gas tanks and gas pumps. The facilities probably operated during the 100-F site construction period and were then removed, along with many other temporary construction or TC buildings.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
100-F-7	Storage Tank	100-FR-1	3,800 L(capacity)	1948	The site consisted of an underground fuel tank that supplied the oil furnace in the 1705-F Building heater room. When the 1705-F Building and surrounding facilities were demolished in 1975, records did not indicate the tank was also removed.	No Action	WSRF 2004-124	10/13/2004 (confirmatory sampling)	10/13/2004 (confirma-tory sampling)	None	2.4 (confirmatory sampling)	Arsenic	2.7 (<BG)	\	\	\
												Barium	72.5 (<BG)	\	\	\
												Beryllium	0.344 (<BG)	\	\	\
												Boron	1	\	\	\
												Cadmium	0.123 (<BG)	\	\	\
												Chromium (total)	9.9 (<BG)	\	\	\
												Cobalt	6 (<BG)	\	\	\
												Copper	11.8 (<BG)	\	\	\
												Lead	4.3 (<BG)	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
												Manganese	262 (<BG)	\	\	\
												Mercury	0.131 (<BG)	\	\	\
												Molybdenum	0.299	\	\	\
												Nickel	10. (<BG)	\	\	\
												Vanadium	38.4 (<BG)	\	\	\
												Zinc	43.8 (<BG)	\	\	\
100-F-8	French Drain	100-FR-1	0.91 m (diameter)	Not Documented	The two French drains are constructed of 91 cm (36-in.) concrete pipe of unknown length buried to a depth that places their upper surfaces a few inches above grade. Both drains are of the type frequently used to receive steam condensate from aboveground steam lines. Steam condensate is nondangerous and nonradioactive.	Rejected	WSRF 97-002									
100-F-9	French Drain	100-FR-1	0.91 m (diameter)	Not Documented	The site consisted of a concrete pipe buried to an unknown depth. The upper surface was a few inches above grade and cobble-filled. The unit was fed by one or more 2.5 cm (1 in.) steel pipes originating from the 105-F Building. Only one pipe was visible prior to the 105-F Reactor decommissioning project. It is believed that the 100-F-9 French Drain received steam condensation via lines from the 105-F miscellaneous storage room building steam heaters.	No Action	WSRF 2004-125	1999 (demolition)	9/21/2004 (confirmatory sampling)	N/A	2.1 (sampling depth)	Arsenic	2.6 (<BG)	\	\	\
												Barium	42.3 (<BG)	\	\	\
												Beryllium	0.22 (<BG)	\	\	\
												Boron	2.3	\	\	\
												Cadmium	0.06 (<BG)	\	\	\
												Chromium (total)	13.9 (<BG)	\	\	\
												Cobalt	5.7 (<BG)	\	\	\
												Copper	13.6 (<BG)	\	\	\
												Lead	4.7 (<BG)	\	\	\
												Manganese	273 (<BG)	\	\	\
												Mercury	0.41	\	\	\
												Molybdenum	0.17	\	\	\
												Nickel	11.6 (<BG)	\	\	\
												Vanadium	48.2 (<BG)	\	\	\
												Zinc	38.3 (<BG)	\	\	\
												COPCs represent those contaminants present at concentrations exceeding laboratory detection limits. All COPC were below RAGs except for mercury; RESRAD modeling indicated the concentration was protective of the environment.				

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
116-F-1	Trench	100-FR-1	1744.0 m x 6.10 m x 3.05 m	1953-1965	The site was commonly known as Lewis Canal. The 105-F Reactor cooling water was diverted to the Columbia River via this trench. The site received liquid wastes from the 105-F, 182-F, 183-F, and 190-F Buildings and decontamination wastes from the 189-F Building. The canal was used for emergency cooling water from 105-F Reactor and backwash water from the water treatment facilities (182-F, 183-F). Received 100,000,000 L (26,417,205 gal) of effluent; 100 kg (220 lb) sodium dichromate and 10,000 kg (22,046 lb) sulfamic acid. Radiological inventory is 3.4 curies.	Interim Closed Out	CVP-2002-00009	01-Jun-08	01-Feb-03	77,696	4.5	C-14	2.85	\	1.47	\
												Cs-137	0.243	\	0.11	\
												Co-60	0.27	\	0.0549	\
												Eu-152	0.616	\	0.177	\
												Eu-154	0.39	\	0.137	\
												Arsenic	16	\	6	\
												Chromium (hexavalent)	1.5	\	1.5	\
116-F-10	French Drain	100-FR-1	0.9 m (diameter) x 3 m (depth)	1948-1965	The site consisted of a vitrified clay pipe placed in the ground vertically with approximately 3.0 m (10 ft) of sand and gravel beneath the tile. The site received radioactive water rinses and spent nitric acid from the decontamination of fuel element spacers and other reactor hardware, primarily pressure tube caps. In addition, the site received liquid waste (effluent = 400,000 L [105,668 gal]) containing 2,000 kg (4,400 lb) of sodium dichromate, 2,000 kg (4,400 lb) of sodium oxylate, and 2,000 kg (4,400 lb) of sodium sulfamate. The site may have received other chemicals as well.	Interim Closed Out	CVP-2003-00003	22-Oct-02	05-Dec-02	848	4.4	Cs-137	1.5	\	1.1	\
												Co-60	0.143	\	0.102	\
												Eu-152	0.569	\	0.394	\
												U-238	0.689	\	0.487	\
												Chromium (total)	10.6	\	10.5	\
												Chromium (hexavalent)	0.429	\	0.429	\
116-F-11	French Drain	100-FR-1	0.91 m (diameter)	1953-1965	The site received liquid decontamination wastes from the cushion corridor area when reactor hardware was decontaminated. It received 200,000 L (52,834 gal) of effluent. There is no documentation that characterizes the waste.	Interim Closed Out	CVP-2001-00003	See 100-F-19:2								
116-F-12	French Drain	100-FR-1	0.91 m (diameter)	1944-1964	The French drain was used to dispose of effluent pump prime recovered from the 148-F Pumphouse. This drain would have received minimal amounts of leakage or spillage from two pumps located in the facility that were used to supply reactor cooling water to the fish studies facilities.	Interim Closed Out	CVP-2001-00002	See 100-F-19:1								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
116-F-13	French Drain	100-FR-1	Not Documented	Not Documented	The site has been described as a French drain. A review of documents and drawings has found no indication that a French drain ever existed at the 1705-F Experimental Garden. This site appears to be confused with both the 146-FR fish rearing ponds and the 1607-F6 septic tank. It received 10,000 L (2,641 gal) of effluent. There is no documentation that characterizes the waste.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.									
116-F-14	Retention Basin	100-FR-1	145.08 m x 72.85 m x 3.66 m	1945-1965	The site was used as a retention basin to hold the discharged reactor water for a brief period, allowing radioactive decay and thermal cooling to occur before the water was discharged to the Columbia River. The retention basin was a rectangular, concrete-lined, open-top reservoir designed to retain reactor cooling water prior to being discharged to the Columbia River. The basin had an estimated capacity of 5.67E+08 L (1.5E+08 gal.).	Interim Closed Out	CVP-2001-00009	27-Jul-00	16-Jan-02	212,015	>4.6	C-14	3.1 U	25	2	8.6
												Cs-137	1	13	0.63	7.7
												Co-60	0.11 U	23	0.075	7.5
												Eu-152	4.1	420	1.8	150
												Eu-154	0.54 U	43	0.19	14
												Eu-155	0.19 U	1.8 U	0.091	0.33
												Sr-90	0.32	2.7	0.15	1.1
												Ni-63	20	1400	6	420/1.2
												Chromium (total)	29	200	24	130
												Chromium (hexavalent)	2.1	11 J	1.2	6.2
												Cobalt	8.8	7.2	7.7	5.9
116-F-15	Sump	100-FR-1	0.91m x 0.91m x 0.91 m	1944-1973	The unit is a concrete sump near the center of the 108-F Radiobiology Laboratory Building first floor. It is known that alpha contamination experiments were conducted in the 108-F Building. The sump is reported to have received liquid wastes from the 108-F Building sinks, glovebox drains, and ventilation hoods. Since alpha contamination experiments were conducted at the 108-F Building, there is a potential for alpha contamination to be associated with this waste site.	Interim Closed Out	WSRF 2007-002	26-Sep-05	12-Dec-06	86	2.6	Cs-137	0.316	\	0.1	\
												Eu-152	0.07	\	0.06	\
												U-233/234	0.733 (<BG)	\	0 (<BG)	\
												U-238	0.625 (<BG)	\	0 (<BG)	\
												Arsenic	4.4 (<BG)	\	2.7	\
												Barium	190	\	74	\
												Beryllium	0.27 (<BG)	\	0.13	\
												Boron	19.6	\	4.4	\
												Cadmium	0.11 (<BG)	\	\	\
												Chromium (total)	21.3	\	13	\
												Chromium (hexavalent)	1.7	\	0.6	\
												Cobalt	5.9	\	5.5	\
												Copper	15.4 (<BG)	\	14	\
												Lead	26	\	9.8	\
												Manganese	257 (<BG)	\	244	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL Deep[b]
												Mercury	0.19 (<BG)	\	\	\
												Molybdenum	0.97	\	0.66	\
												Nickel	11.1 (<BG)	\	11	\
												Vanadium	41 (<BG)	\	38.3	\
												Zinc	43 (<BG)	\	38.5	\
												Aroclor-1254	0.025	\	0.014	\
												Aroclor-1260	0.027	\	\	\
												Aroclor-1260 exceeded RAGs but RESRAD modeling indicated it was protective of the environment.				
116-F-16	Outfall	100-FR-1	30.48 m x 4.57 m		This site consists of an open-topped, compartmentalized, reinforced-concrete outfall structure. The site transported effluent from the EAF and aquatic biology laboratory to the Columbia River. The lower portion is intact and remains exposed.	Interim Closed Out	WSRF 2006-039	See 100-F-43								
116-F-2	Trench	100-FR-1	158.80 m x 6.10 m x 3.35 m	1950-1965	The site was an open liquid waste trench. The site received cooling water effluent from the 107-F Retention Basin during reactor outages due to fuel ruptures. During deactivation of the 105-F Reactor, the unit received overflow water from the 105-F Storage Basin via the retention basin. It received 60,000,000 L (15,850,323 gal) of effluent; 60,000 kg (132,277 lb) sodium dichromate. Radiological inventory is 15 curies.	Interim Closed Out	CVP-2001-00005	22-Nov-00	29-May-02	113,007	>4.6	C-14	0.085 U	6.62 J	-0.911	3.87
												Cs-137	0.419	44.7	0.262	20
												Co-60	0.18 U	2.07	0.0459	1.3
												Eu-152	1.02	85.7	0.413	41.6
												Eu-154	0.39 U	8.9	0.131	4.21
												Chromium (hexavalent)	1.6	1.4	1.6	0.91
116-F-3	Trench	100-FR-1	30.48 m x 6.10 m x 3.35 m	1947-1951	The trench received reactor cooling water during a 1947 fuel rupture occurrence. In 1951, the trench received sludge from the 105-F Fuel Storage Basin. It received 7,000,000 L (1,849,204 gal) of effluent; 4 kg (8.8 lb) of sodium dichromate. Radiological inventory is 0.0021 curies.	Interim Closed Out	CVP-2002-00008	Oct-02	26-Feb-03	5205	4.7	Eu-152	0.357	\	0.274	\
												Eu-154	0.4U	\	0.182	\
												Chromium (hexavalent)	0.74	\	0.74	\
116-F-4	Crib	100-FR-1	1.83 m x 1.83 m x 3.05 m	1950-1952	The site received coolant water from pressure tubes containing ruptured fuel elements. It was estimated that 280 curies of fission products were discharged to the crib during its operation (UNI-946). It was also assumed that the contaminated soil occupied a volume of 6 by 6 by 7.6 m (20 by 20 by 25 ft). Received 4,000 L (1056 gal) of effluent; 0.004 kg (19.85 lb) sodium dichromate. Radiological inventory is 3.5 curies.	Interim Closed Out	CVP-2001-00006	20-Sep-93	10-Nov-93	700	5.5	Am-241	0.027 U	\	0.015	\
												Cs-137	1.8	\	0.9	\
												Co-60	0.05 U	\	0.025	\
												Eu-152	0.1 U	\	0.049	\
												Eu-154	0.07 U	\	0.034	\
												Pu-239/240	0.074	\	0.036	\
												Sr-90	0.7 U	\	0.35	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												U-233/234	0.65	\	0.53	\
												U-238	0.56	\	0.51	\
												Chromium (total)	9.9	\	\	\
												Chromium was analyzed for but not identified as a COC, therefore no statistical calculations were performed.				
116-F-5	Crib	100-FR-1	3.05 m x 3.05 m x 2.74 m	1954-1964	The site was used to dispose of liquid decontamination wastes from the 105-F Reactor ball washer assembly. It served to clean and decontaminate small, steel-jacketed boron balls used in the Ball 3X safety system. The ball washer assembly was located in the transfer basin area of the 105-F Reactor Building. It received 3,000 L (792 gal) of effluent; nitric acid. Radiological inventory is 0.00092 curies.	Interim Closed Out	CVP-2001-00007	30-Jul-97	30-Jul-97	None	References to excavation depths in CVP range from 3.4 to 3.7 m	Co-60	0.0280 U	\	0.028	\
												Cs-137	0.222	\	0.1984	\
												Eu-155	0.0561	\	\	\
												U-238	0.886	\	\	\
												Arsenic	1.8	\	\	\
												Chromium (hexavalent)	0.03UJ	\	\	\
												Europium -155, uranium, arsenic, and hexavalent chromium were also analyzed for and detected but not identified as a COC, therefore no statistical calculations were performed.				
116-F-6	Trench	100-FR-1	91.44 m x 30.84 m x 3 m	1952-1965	The site was an open excavation used to receive reactor cooling water. The site received water diverted during reactor shutdowns when maintenance was necessary on the effluent system. This practice was used during several reactor upgrades. Contaminants would include Eu-152, Co-60, Eu-154, Cs-137, and sulfamic acid (3,000 kg [6600 lb]). It received 100,000 L (25,417 gal) of effluent. Radiological inventory is 6.5 curies.	Interim Closed Out	CVP-2002-00010	01-Oct-02	06-Jan-03	32,156	5.1	Cs-137	1.31	12.2	0.525	6.08
												Co-60	0.083	0.514	0.0267	0.34
												Eu-152	0.631	12.7	0.277	7.51
												Eu-154	0.15 U	1.24	0.0577	0.727
												Sr-90	4.14	31.8	0.969	12.8
												Chromium (hexavalent)	0.53	1.7	0.53	1.32
116-F-7	Crib	100-FR-1	6.10 m x 6.10 m x 5.18 m	1960-1965	The site consisted of a crib and pipeline that has been filled with gravel and covered with clean soil. The pipeline originated at the 117-F Building and terminated at the crib site. The site received drainage from confinement exhaust system filter seal pits in the 117-F Building. The site received 300,000 L (79,251 gal) of effluent. Radiological inventory is 0.00014 curies.	No Action	WSRF 2004-128	10/12/2004 (confirmatory sampling)	10/12/2004 (confirmatory sampling)	N/A	5.8 (sampling depth)	Cs-137	0.046 (<BG)	\	\	\
												Antimony	0.302 (<BG)	\	\	\
												Arsenic	2.4 (<BG)	\	\	\
												Barium	54.6 (<BG)	\	\	\
												Beryllium	0.316 (<BG)	\	\	\
												Boron	2.3	\	\	\
												Cadmium	0.115 (<BG)	\	\	\
												Chromium (total)	36.7 (<BG)	\	\	\
												Cobalt	7.2 (<BG)	\	\	\
												Copper	17.8 (<BG)	\	\	\
												Chromium (hexavalent)	0.742	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
												Lead	2.9 (<BG)	\	\	\
												Manganese	242 (<BG)	\	\	\
												Mercury	0.145 (<BG)	\	\	\
												Molybdenum	0.449	\	\	\
												Nickel	40.9	\	\	\
												Vanadium	42.3 (<BG)	\	\	\
												Zinc	35 (<BG)	\	\	\
												Aroclor-1260	0.017	\	\	\
												Di-n-butylphthalate	0.02	\	\	\
												The COPCs represent those contaminants present at concentrations exceeding laboratory detection limits. Nickel concentrations exceeded RAGs but RESRAD modeling for analogous sites indicate that it is protective of the environment.				
116-F-7:2 (subsite)	Radioactive Process Sewer	100-FR-1	0.10 m (diameter) 185 m (length)	Not Documented	The pipe was used to transfer water from the 132-F-5 Filter Building sump pump discharge to the 116-F-7 Seal Water Crib. The vented pipeline was fed from a sump pump and sloped for gravity drain with an average depth of about 1.5 m (4.9 ft) below grade. The fine soil at the top of the crib soil column represents the worst-case location for contamination to be found, including the influent pipeline. The absence of detectable radiation reading and pipeline scaling indicates a low risk of significant contamination.	No Action	WSRF 2005-044	N/A								
116-F-8	Outfall	100-FR-1	8.23 m x 4.27 m x 7.9 m	1945-1965	The outfall was constructed of a reinforced, compartmentalized concrete weir box, with walls extending from 7.6 m (25 ft) below grade and 0.3 m (1 ft) above grade. The outfall was designed as an open concrete structure for discharging reactor effluent cooling water from the 116-F-14 (107-F Retention Basin) to the center of the Columbia River via 100-F-39 River Pipelines. The outfall could have also received reactor water that had been diverted for fish studies and other process wastes from the EAF.	Interim Closed Out	WSRF 2006-038	See 100-F-42								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
116-F-9	Trench	100-FR-1	154.53 m x 3.05 m	1963-1976	The site was a leaching trench that received wastewater from the cleaning of animal pens in the EAF. The pipelines that originated at the 141-C Building and terminated at the trench are documented in 100-F-29. The total estimated radioactive inventory of the 116-F-9 Animal Leach Trench contaminated soil column was 4.1 curies. The site received 300,000,000 L (79,251,615 gal) of effluent.	Interim Closed Out	CVP-2001-00008	04-Sep-01	10-Apr-02	49,405	5.7	C-14	0.688 U	8.5 J	0.69	2
												Cs-137	0.05 U	3.45	0.021	1.2
												Co-60	0.051 U	2.34	0.022	0.68
												Eu-152	0.12 U	12.6	0.049	3.5
												Sr-90	3.3	19.3	1.4	8.3
												Chromium (hexavalent)	0.42 U	1.2	0.42	1.2
118-F-1	Burial Ground	100-FR-2	182.88 m x 152.40 m	1954-1965	The site is a burial ground that received radioactive equipment and other miscellaneous wastes from 100-F Reactor operations. There are three unlined trenches and a pit present at the site.	Interim Closed Out	CVP-2007-00001	27-Dec-05	22-Jun-07	88,800	5.5	Am-241	0.194U	\	0.063	\
												C-14	4.27U	\	0.83	\
												Cs-137	0.72	\	0.21	\
												Co-60	0.13	\	0.038	\
												Eu-152	0.18U	\	0.054	\
												Eu-154	0.133U	\	0.053	\
												Ni-63	7.2	\	2.3	\
												Pu-238	0.074U	\	0.028	\
												Pu-239/240	0.24	\	0.11	\
												Silver-108m	0.026	\	0.017	\
												Sr-90	1.3	\	0.38	\
												Tritium	3.09 U	\	1.4	\
												U-238	1.3	\	0 (<BG)	\
												Cadmium	0.1	\	\	\
												Lead	7.9	\	5.4	\
												Mercury	0.0076	\	\	\
118-F-2	Burial Ground	100-FR-2	112.17 m x 99.36 m	1945-1965	This burial ground, formerly called Solid Waste Burial Ground No. 1, was the original solid waste disposal site for the 100-F Area. Eight trenches contain miscellaneous solid waste from 105-F and one trench contains solid waste from the biology facilities. According to historical documentation, these trenches were covered to grade prior to 1956. The burial ground contains several long metal pipes with wooden lids used to dispose of contaminated animal carcasses.	Interim Closed Out	CVP-2007-00002	17-Jan-06	08-Aug-07	16,100 BCM	4.6	Cs-137	0.093	\	0.069	\
												Co-60	0.037 U	\	0.017 U	\
												Eu-152	0.096 U	\	0.044 U	\
												Eu-154	0.139 U	\	0.059 U	\
												Ni-63	-0.84 U	\	-1.071 U	\
												Pu-238	0.110 U	\	0.083 U	\
												Pu-239/240	0.314	\	0.21	\
												Sr-90	0.132 U	\	0.12 U	\
												U-233/234	0.681	\	0 (<BG)	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL Deep[b]
												U-238	0.839	\	0 (<BG)	\
												Chromium (total)	13	\	10.4 (<BG)	\
												Lead	6.8	\	5.7 (<BG)	\
												Mercury	0.02 U	\	0.02 U (<BG)	\
118-F-3	Burial Ground	100-FR-2	53.34 m x 15.24 m x 4.5 m	1952-1952	This site received irradiated parts from the Ball 3X Project at the 105-F Reactor during 1952. The site received irradiated reactor parts that were removed during the project to convert the 105-F Reactor from the Liquid 3X to the Ball 3X safety systems. The waste was primarily 38 to 61 VSR thimbles and also step plugs. The principal radionuclide was short-lived Co-60.	Interim Closed Out	CVP-2006-00008	31-Jan-06	10-Aug-06	4,060	3.5	Cs-137	0.16	\	0.144	\
												Co-60	0.378	\	0.378	\
												Ni-63	23.7	\	16.5	\
												Sr-90	0.276	\	0.235	\
												Barium	116	\	104	\
												Boron	12.7	\	10.4	\
118-F-4	Crib	100-FR-2	3.05 m x 3.05 m	1949-1949	The site was a small, unlined pit constructed to receive silica gel from the 115-F drying towers. The site contains 270 kg (0.3 ton) of silica gel removed from a gel tower in one of the 115-F Dryer Rooms.	No Action	WSRF 2004-129	10/7/2004 (confirmatory sampling)	10/7/2004 (confirma-tory sampling)	N/A	3 (sampling depth)	Cs-137	0.856 (<BG)	\	\	\
												Antimony	0.38 (<BG)	\	\	\
												Arsenic	2.3 (<BG)	\	\	\
												Barium	394	\	\	\
												Beryllium	0.55 (<BG)	\	\	\
												Boron	43.6	\	\	\
												Cadmium	0.20 (<BG)	\	\	\
												Chromium (total)	7.6 (<BG)	\	\	\
												Cobalt	5.3 (<BG)	\	\	\
												Copper	16 (<BG)	\	\	\
												Lead	14.4	\	\	\
												Manganese	228 (<BG)	\	\	\
												Molybdenum	0.66	\	\	\
												Nickel	8.9 (<BG)	\	\	\
												Vanadium	40 (<BG)	\	\	\
												Zinc	78.2	\	\	\
												Acetone	0.014	\	\	\
												Acenaphthene	1	\	\	\
												Benzo(a) anthracene	0.022	\	\	\
												Benzo(a)pyrene	0.016	\	\	\
												Benzo(b) fluoranthene	0.086	\	\	\
												Benzo(g,h,i) perylene	0.025	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
												Benzo(k) fluoranthene	0.012	\	\	\
												Chrysene	0.056	\	\	\
												Fluoranthene	0.11	\	\	\
												Indeno(1,2,3-cd)pyrene	0.13	\	\	\
												Phenanthrene	0.11	\	\	\
												Pyrene	0.1	\	\	\
												COPCs represent contaminants present at concentrations exceeding laboratory detection limits. Barium, lead, and zinc concentrations exceeded RAGs but RESRAD modeling for analogous sites indicates they are protective of the environment.				
118-F-5	Burial Ground	100-FR-2	152.40 m x 45.72 m x 4.57 m	1954-1975	The site is a single, unlined trench that received radioactive sawdust from the floors of animal pens in the 100-F Area EAF. The site contains low-level activity sawdust and other solids from floors of dog kennels and swine pens. The site now appears as a large, raised mound. 118-F-5A is a small subsite included in the 118-F-5 Waste Site code, which also was remediated and sampled for verification.	Interim Closed Out	CVP-2007-00003	28-Nov-05	12-Sep-07	25,500 BCM	5.5		118-F-5	118-F-5A	118-F-5	118-F-5A
												C-14	0.15 U	-0.061	-0.202 U	-0.558U
												Cs-137	0.030 U	0.037	0.014 U	0.015U
												Co-60	0.030 U	0.037U	0.015 U	0.037U
												Pu-239/240	0.302 U	0.017U	0.120 U	0.010U
												Sr-90	0.140 U	0.182U	0.076 U	0.114U
118-F-6	Burial Ground	100-FR-2	121.92 m x 60.96 m x 5.49 m	1965-1973	The site is an unlined burial ground that received animal and laboratory wastes related to the 100-F Area EAF. This unit contains animal and laboratory wastes including plutonium-238-contaminated animal ash. The site did not receive reactor related waste.	Interim Closed Out	CVP-2008-00001	12-Dec-05	13-Dec-07	13,100 BCM	6.5	Cs-137	1.62	\	0.214	\
												Co-60	\	\	0.018 (ND)	\
												Eu-152	\	\	0.043 (ND)	\
												Pu-238	\	\	0.030 (ND)	\
												Pu-239/240	\	\	0.016 (ND)	\
												Sr-90	0.462	\	2.701	\
												Ur-233-234	0.397 (<BG)	\	\	\
												Ur-238	0.391 (<BG)	\	\	\
												Bis (2-ethylhexyl) phthalate	0.042	\	\	\
												Twelve focused samples were collected from the 118-F-6 waste site. Statistical analysis (e.g., calculation of a 95 percent UCL value) is inappropriate to use for evaluation of focused samples; therefore, the sample results for each focused sample are evaluated using the maximum detected activity for each COC/COPC and comparing the value directly to the cleanup level.				
118-F-7	Storage	100-FR-2	6.15 m x 3.80 m x 2.44 m	1945-1965	The site was an inactive solid waste storage vault used for temporary storage of slightly contaminated reactor parts that could be recovered and reused for the 100-F Area reactor operations.	Interim Closed Out	CVP-2006-00007	31-Jan-06	06-Jun-06	104	3	Cs-137	0.403	\	0.23 (ND)	\
												Co-60	0.23	\	0.301	\
												Silver-108m	0.077	\	0.0351 (ND)	\
												Sr-90	0.249	\	0.183	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL Deep[b]
												Cadmium	0.21 U	\	0.21 (ND)	\
												Copper	12.5	\	12.2	\
												Lead	18.8	\	10.9	\
												Lead exceeded RAGs but RESRAD modeling indicated it was protective of the environment.				
118-F-8:1 (subsite)	Reactor	100-FR-1	Not Documented	1944-1965	This subsite included the reactor ancillary support areas, below-grade structures, and underlying soils. The ancillary support areas consisted of the office areas, the reactor control room, tool storage rooms, restrooms, cooling water influent areas, change rooms, ventilation equipment areas, and electrical systems areas. The reactor areas were divided into zones as described in the SAP. 100-F-18:1 included zone 2 (valve pit); zone 3 (gas recirculation tunnel, solids feed area, flow laboratory basement, east water tunnel and the trench under the accumulator room); zone 4 (west inlet water tunnel, east inlet water tunnel, 315 exhaust plenum, 316 exhaust plenum, pipe tunnel, and southeast tunnel); and the equipment decontamination areas (no zone). Zone 1 requires additional remediation and will be included in a future CVP.	Interim Closed Out	CVP-2003-00017	CY 1999	01-Dec-03	22132	Zone 2: 4.8 (concrete and soil)	Am-241	0.01 U	\	0.0058U	\
												Ba-133	0.025 U	\	0.00903U	\
												C-14	2.98	\	1.24	\
												Cs-137	4.13	\	1.86	\
												Co-60	0.336	\	0.137	\
												Eu-152	0.877	\	0.353	\
												Eu-154	0.114	\	0.0441U	\
												Eu-155	0.081	\	0.0524U	\
												Ni-63	10.4	\	7.08	\
												Pu-238	0.153	\	0.0377U	\
												Pu-239/240	0.0156	\	0.0065	\
												Sr-90	0.27	\	0.146	\
												Tc-99	0.109	\	-0.196U	\
												U-233/234	0.295	\	<BG	\
												U-235	0.025	\	<BG U	\
												U-238	0.26	\	<BG	\
												Chromium (hexavalent)	2.4 (shallow)	2.1	1.4 (shallow)	0.95
												Lead	93 (shallow)	59	41 (shallow)	34
												Mercury	0.45 (shallow)	0.22	0.15 (shallow)	0.11
												Aroclor-1254	0.36 (shallow)	34 (PQL)	0.2 (shallow)	\
												Aroclor-1016	0.033 (shallow)	34 (PQL)	0.033 (shallow)	\
												Aroclor-1260	0.17 (shallow)	62 (PQL)	\	\
											Zone 3: 4.4 (concrete and soil)	Am-241	0.0277	\	0.00421	\
												Ba-133	0.0237	\	0.00523	\
												Cs-137	0.741	\	0.141	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Co-60	0.17	\	0.0383	\
												Eu-152	0.237	\	0.0227	\
												Eu-154	0.00982	\	0.00982	\
												Eu-155	0.679	\	0.0294	\
												Pu-238	0.0262	\	0.00307	\
												Pu-239/240	0.00931	\	0.00205	\
												Sr-90	0.188	\	0.069	\
												Chromium (hexavalent)	17	1.7	4.9	1.7
												Lead	75	\	14	14
													--	Deep Concrete	--	Deep Concrete
											Zone 4: 6.1 (concrete)	Am-241	\	0.238	\	0.0309
												Ba-133	\	0.285	\	0.065
												Cs-137	\	2.18	\	7.41
												Co-60	\	0.547	\	0.168
												Eu-152	\	26.6	\	3.21
												Eu-154	\	2.68	\	0.295
												Eu-155	\	0.105	\	0.0422
												Pu-238	\	0.0622	\	0.00988
												Pu-239/240	\	1.29	\	0.156
												Sr-90	\	12.7	\	2.65
												Lead	\	60	\	22
												Lead	\	60	\	22
118-F-8:2 (subsite)	Reactor	100-FR-1	82.70 m x 95.80 m x 28.30 m	1944-1965	This site is the 105-F Reactor core and ISS project. Until the start of the ISS Project, the F Reactor had been in a condition of minimum S&M. The primary objective of the 105-F Reactor ISS Project is to provide storage for up to 75 years with minimal maintenance required. The 0.9 to 1.5 m (3 to 5 ft) thick concrete walls and the welded door provide the security barrier for the facility; therefore, a locked fence around the ISS Reactor Structure is not required.	Accepted	Wagoner et al., 1998	N/A					Deep Soils (1 ft)	Deep Soils (8-10 ft)	Deep Soils (1 ft)	Deep Soils (8-10 ft)

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
118-F-8:3* (subsite)	Reactor	100-FR-1	23.80 m x 21.60 m x 6.40 m	1944-1965	The FSB, located on the south side of the 105-F Building, was the underwater collection, storage, and transfer facility for irradiated fuel elements discharged from the reactor. This area includes the fuel element discharge pickup area, fuel storage area (basin), fuel transfer area, and wash pad area. The waste was concrete and soil associated with the FSB. The primary source of contamination to the concrete structures and soils was sodium dichromate-treated reactor cooling water and FSB that became contaminated through contact with fuel elements and components from the reactor cooling system.	Interim Closed Out	CVP-2003-00017	CY 1999	01-Dec-03	22132	6.4	Am-241	5.2	3.29	1.93	0.704
												Ba-133	1.1 U	0.36	0.203	0.0672
												C-14	4.66	26.4	33.9	6.18
												Cs-137	392	6.3	151	97.6
												Co-60	34.1	463	10.4	1.96
												Eu-152	342	53.9	108	14.1
												Eu-154	45.3	6.67	13.7	1.84
												Eu-155	2.6 U	0.93	0.476	0.168
												Tritium	0.846	0.777	0.332	0.408
												Ni-63	1170	112	362	40.5
												Pu-238	0.659	0.398	0.275	0.106
												Pu-239/240	17.1	5.42	7.27	1.43
												Sr-90	235	67	87.5	15.1
												Tc-99	\	\	\	\
												U-233/234	0.542	0.486	\	\
												U-235	0.131	0.052	\	\
												U-238	0.643	0.535	\	\
												Chromium (hexavalent)	1	0.42	1	1.4
												Barium	52	44	46	38
												Lead	6.1	3.5	3.9	3.5
												Mercury	0.59	0.02	0.4	0.02
												Aroclor-1254	1100	35	0.38	0.036
												Aroclor-1016	\	\	\	\
												Aroclor-1260	\	\	\	\
												Am-241	0.165U	0.112	0.110 U	0.081

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
118-F-8:4 (subsite)	Unplanned Release	100-FR-1	23.80 m x 21.60 m	1944-1965	This subsite consists of an area of soil at the western boundary of the 118-F-8:3, FSB excavation. The FSB held dichromate-treated reactor cooling water and served as an underwater collection, storage, and transfer facility for irradiated fuel elements discharged from the reactor. The water was primarily contaminated by activated elements spilled into the FSB during fuel discharge and fission products, uranium, and transuranics introduced by fuel cladding failures.	Interim Closed Out	CVP-2007-00004	14-Mar-07	22-Jun-07	1,650 BCM	8	Ba-133	0.051U	0.045	0.020 U	0.022 U
												C-14	0U	0.523UJ	-0.325 U	0.070 U
												Cs-137	0.315	6.62	0.281	4.52
												Co-60	0.049U	0.274	0.019 U	0.186
												Eu-152	0.185	4.39	0.16	3.01
												Eu-154	0.161U	0.501U	0.061 U	0.181 U
												Eu-155	0.128U	0.116U	0.050 U	0.057 U
												Ni-63	1.87U	26.1	1.26 U	18.7
												Pu-238	0.035U	0.077U	0.023 U	0.056 U
												Pu-239/240	0.062U	0.077	0.063 U	0.52
												Sr-90	0.175U	3.21	0.151 U	2.2
												Tritium	3.04U	1.77UJ	2.85 U	1.38 U
												U-233/234	0.579	0.564	0 <BG	0 <BG
												U-235	0.034	0.12	0 <BG	0 <BG
												U-238	0.521	0.677	0 <BG	0 <BG
												Barium	74.3	57.1	70.1	52.6
												Chromium (hexavalent)	0.26	0.32	\	0.26
												Lead	10.3	5.8	9	5.5
												Mercury	0.53	0.05	0.41	\
												Selenium	1.5	1.3U	\	\
												Aroclor-1016	0.014 U	0.014 U	\	\
												Aroclor-1221	0.014 U	0.014 U	\	\
												Aroclor-1232	0.014 U	0.014 U	\	\
												Aroclor-1242	0.014 U	0.014 U	\	\
												Aroclor-1248	0.014 U	0.014 U	\	\
												Aroclor-1254	0.014 U	0.014 U	\	\
												Aroclor-1260	0.014 U	0.049	\	\
												Aroclor-1260	0.014 U	0.049	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
118-F-9	Burial Ground	100-FR-2	45.72 m x 9.14 m	Not Documented	The site contains one trench running east to west. The site received undocumented miscellaneous solid wastes from animal research studies at the EAF. It appears to have been backfilled and vegetation has reestablished itself. Historical aerial photography does not show a burial trench in the suspected area of the 118-F-9 waste site, with the exception of the trenches associated with the 100-F-20 waste site. Geophysical surveys performed in the area (attached) indicated three anomalous zones, which were excavated and determined to contain no indication of a former burial ground. Soil samples were collected from the site and showed no contamination. Based on the combination of geophysical data and sample results, the 118-F-9 Burial Ground does not appear to be located within the suspected area.	Rejected	WSRF 2006-048	N/A								
120-F-1	Trench- Glass Dump Waste Site	100-FR-2	7.62 m x 2.44 m	Not Documented	The site is an inactive trench that runs east to west. The site is covered with approximately 0.61 m (2 ft) of fluorescent tubes, incandescent light bulbs, instrument vacuum tubes, and small AAA, C, and D batteries. The site also contains an assortment of various- sized chemical bottles.	Interim Closed Out	WSRF 2008-028	07-Sep-08	18-Mar-98	1,505 BCM	6.5	Antimony	\	0.91	\	0.91 (<BG) (max)
												Arsenic	3.3	3	2.9 (<BG)	2.5 (<BG)
												Barium	72	81	58.2 (<BG)	65.8 (<BG)
												Beryllium	1	0.34	0.73 (<BG)	0.26 (<BG)
												Boron	5.6	2	4.6	1.6
												Chromium (total)	8.1	13	7.4 (<BG)	11.7 (<BG)
												Cobalt	6.1	8.5	5.3 (<BG)	7.1 (<BG)
												Copper	13.3	13.3	12.6 (<BG)	12.2 (<BG)
												Chromium (hexavalent)	1.8	0.3	\	\
												Lead	11	4.4	6.1 (<BG)	2.9 (<BG)
												Manganese	314	378	259 (<BG)	318 (<BG)
												Mercury	0.65	\	\	\
												Molybdenum	0.85	\	\	\
												Nickel	11	13	9.3 (<BG)	11.8 (<BG)
												Selenium	\	1.8	\	\
												Vanadium	49.7	67.7	38.5 (<BG)	53.9 (<BG)
												Zinc	47.1	42.5	37.5 (<BG)	37.3 (<BG)
												Chloride	\	7.6	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
												Fluoride	3.9	\	\	\
												Nitrate	18.6	25.3	\	\
												Sulfate	8410	13	\	6.4 (<BG)
												Bis(2-ethylhexyl) phthalate	0.2	0.1	0.11	0.12
												Aroclor-1254	0.023	\	\	\
												Aroclor-1260	0.01	\	\	\
												Dibenz(a,h) anthracene	0.025	\	\	\
												Di-n-butylphthalate	\	0.027	\	\
												Alpha-Chlordane	0.01	0.0021	\	\
												Gamma-Chlordane	0.013	0.0022	\	\
												DDE	0.0018	\	\	\
												DDT	0.0021	\	\	\
												Endosulfan I	0.0018	\	\	\
												RAGs were exceeded for mercury for the southeast portion and for selenium for the northwest portion. RESRAD modeling indicates concentrations were protective of the environment.				
													South	North	South	North
126-F-1	Coal Ash Pit	100-FR-2	329.0 m x 170.80 m(North Portion) 329.0 m x 118.60 m (South Portion)	1944-1965	The ash pit was the result of the 100-F Area coal-fired steam plant that operated between 1944 and 1965. Coal ash contains various amounts of fly ash, bottom ash, and boiler slag. Unknown amounts of coal ash from the 184-F Powerhouse were sluiced to this unit with raw river water. The ash has been analyzed using the EP Toxicity Test in accordance with WAC 173-303, and no hazardous materials were found. This site also received low-level radionuclides from effluent system leakage. Radioactive contamination in excess of 50,000 cpm exists in the northwest corner of the pit.	Interim Closed Out	CVP-2002-00004	05-Oct-01	16-Jul-02	100,964	4	Co-60	1.63	0.1	0.27	0.041
												Cs-137	1.41	1.12	0.39	0.39
												Eu-152	15.3	2.7	3.5	0.66
												Eu-154	1.9	0.247	0.45	0.091
												Eu-155	0.8 U	0.32	0.11	0.12
												Cs-137	0.071	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
126-F-2	Dumping Area	100-FR-1	228.90 m x 41.15 m; 232.0 m x 65.0 m	1945-1965	The unit consists of covered, reinforced-concrete basins, having a capacity of about 3.7E+07 L (1E+07 gal), separated in the center by a pump room. Originally, the site was used to store river water being processed for reactor coolant. Beginning in the 1970s, this site received demolition rubble and inert waste from demolition of buildings 183-F, 190-F, 189-F, 185-F, and 171-F.	Interim Closed Out	WSRF 2006-017	01-Jul-05	14-Dec-05	28,986	Concrete Surface	U-233/234	0.532 (<BG)	\	\	\
												U-238	0.761 (<BG)	\	\	\
												Antimony	0.48 (<BG)	\	\	\
												Arsenic	3 (<BG)	\	\	\
												Barium	82.4 (<BG)	\	\	\
												Beryllium	0.3 (<BG)	\	\	\
												Boron	5.6	\	\	\
												Chromium (total)	10.9 (<BG)	\	\	\
												Cobalt	6.2 (<BG)	\	\	\
												Copper	17.4 (<BG)	\	\	\
												Lead	17.2	\	\	\
												Manganese	274 (<BG)	\	\	\
												Molybdenum	0.39	\	\	\
												Nickel	10.3 (<BG)	\	\	\
												Selenium	0.37 (<BG)	\	\	\
												Vanadium	41.6 (<BG)	\	\	\
												Zinc	76.9 (<BG)	\	\	\
												Aroclor-1254	0.074	\	\	\
												Acenaphthene	0.17	\	\	\
												Anthracene	0.41	\	\	\
												Benzo(a) anthracene	0.76	\	\	\
												Benzo(a)pyrene	0.7	\	\	\
												Benzo(b) fluoranthene	0.56	\	\	\
												Benzo(g,h,i) perylene	0.27	\	\	\
												Benzo(k) fluoranthene	0.76	\	\	\
												Chrysene	0.84	\	\	\
												Dibenz(a,h) anthracene	0.2	\	\	\
												Fluoranthene	1.8	\	\	\
												Fluorene	0.21	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Indeno(1,2,3-cd)pyrene	0.26	\	\	\
												Phenanthrene	1.6	\	\	\
												Pyrene	1.8	\	\	\
												TPH	1650	\	\	\
												The above analytes represent those contaminants detected by laboratory analysis and are subsequently considered as COPCs. Maximum concentrations exceeded RAGs but passed RESRAD modeling for: lead, zinc, Aroclor-1254. Maximum concentrations exceeded RAGs but are a result of asphalt cross-contamination and are not considered in attainment of soil RAGs for: benzo(a) anthracene, benzo(a)pyrene, benxo(b) fluroanthene, benzo(k) fluoranthene, chrysene, or total petroleum hydrocarbons.				
												Arsenic	2.1 (<BG)	\	\	\
128-F-1	Burn Pit	100-FR-2	30.48 m x 30.48 m	1945-1965	The site was used to dispose of nonradioactive, combustible materials, such as paint waste, office waste, and chemical solvents from the 100-F Area. The site has been backfilled. The site has been evaluated and determined to meet RAOs.	No Action	WSRF 2003-35	4/28/2003 (confirmatory sampling)	4/28/2003 (confirma-tory sampling)	N/A	1.8 (sampling depth)	Barium	67.4 (<BG)	\	\	\
												Chromium (total)	12.1 (<BG)	\	\	\
												Lead	3.1 (<BG)	\	\	\
												Total petroleum hydrocarbons	4.4	\	\	\
												beta-BHC	0.0038	\	\	\
												COPCs represent contaminants present at concentrations exceeding laboratory detection limits.				
128-F-2	Burn Pit	100-FR-1	45.72 m x 18.29 m	1945-1965	The pit was an irregularly shaped depression that was used for burning wastes. Nonradioactive, combustible materials (e.g., vegetation, office waste, paint waste, and chemical solvents) have been burned at the site. There are also some large metal materials present at the site, such as hardware, machinery, and other noncontaminated miscellaneous equipment, and vitrified clay pipe.	Interim Closed Out	WSRF 2008-031	17-Aug-05	11-Dec-07	21,900	6.0	Cs-137	0.218	\	\	\
												Antimony	0.92(<BG)	\	\	\
												Arsenic	4.4 (<BG)	\	3.5 (<BG)	\
												Barium	84.9 (<BG)	\	72.9 (<BG)	\
												Beryllium	0.26 (<BG)	\	0.39 (<BG)	\
												Boron	1.8	\	2.1	\
												Cadmium	0.22 (<BG)	\	\	\
												Chromium (total)	23.5	\	26.7	\
												Cobalt	6.0 (<BG)	\	6.4 (<BG)	\
												Copper	23.4	\	39.6	\
												Chromium (hexavalent)	0.53	\	0.80	\
												Lead	9.0 (<BG)	\	10.8	\
												Manganese	304 (<BG)	\	275 (<BG)	\
												Mercury	0.04 (<BG)	\	0.07 (<BG)	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Molybdenum	\	\	0.67	\
												Nickel	\	\	13.0 (<BG)	\
												Vanadium	34.2 (<BG)	\	\	\
												Zinc	47.2 (<BG)	\	38.7 (<BG)	\
												Bis(2-ethylhexyl) phthalate	0.085	\	0.080	\
												Dibenzo (a,h) anthracene	0.048	\	0.143	\
												Aldrin	0.0022	\	0.0017	\
												Beta-BHC	0.0047	\	0.027	\
												Chlordane	\	\	0.0101	\
												4,4'-DDD	\	\	0.003	\
												4,4'-DDE	0.0050	\	0.0064	\
												4,4'-DDT	0.0055	\	0.045	\
												Endrin aldehyde	0.0051	\	0.0261	\
												Endosulfan	\	\	0.0061	\
												Heptachlor	0.0033	\		\
												Arolclor-1254	\	\	0.044	\
												TPH	\	\	48.7	\
												Acenaphthene	\	\	0.063	\
												Anthracene	\	\	0.12	\
												Benzo(a) anthracene	\	\	0.35	\
												Benzo(a)pyrene	\	\	0.29	\
												Benzo(b)-fluoranthene	\	\	0.23	\
												Benzo(g,h,i)-perylene	\	\	0.19	\
												Benzo(k) fluoranthene	\	\	0.30	\
												Carbazole	\	\	0.062	\
												Chrysene	\	\	0.39	\
												Diethylphthalate	\	\	0.099	\
												Dimethyl-phthalate	\	\	0.021	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
												Fluoranthene	\	\	0.356	\
												Fluorene	\	\	0.046	\
												Indeno(1,2,3-cd)pyrene	\	\	0.18	\
												Phenanthrene	\	\	0.264	\
												Pyrene	\	\	0.381	\
128-F-3	Burn Pit	100-FR-2	30.48 m x 30.48 m	Not Documented	The site was used as a burn pit associated with 100-F EAF. The site was overlain by coal ash from the 126-F-1 waste site. A housekeeping action was performed to remove the coal ash.	Interim Closed Out	WSRF 2006-042	20-Sep-05	11-Apr-06	690	1.1	Arsenic	3.2	\	2.5 (<BG)	\
												Barium	290	\	261	\
												Beryllium	0.62	\	0.5 (<BG)	\
												Boron	21.8	\	42.4	\
												Cadmium	0.26 (<BG)	\	\	\
												Chromium (total)	69.3	\	25.8	\
												Cobalt	7.2	\	6.3 (<BG)	\
												Copper	25.7	\	21.1 (<BG)	\
												Lead	5.7	\	4.5 (<BG)	\
												Manganese	350	\	293 (<BG)	\
												Mercury	0.03 (<BG)	\	\	\
												Nickel	12.5	\	10.9 (<BG)	\
												Vanadium	52.4	\	41.7 (<BG)	\
												Zinc	59.6	\	42.8 (<BG)	\
												Aldrin	0.00056 (<BG)	\	\	\
												Alpha-Chlordane	0.0028	\	\	\
												beta-BHC	0.0054 D	\	0.003	\
												4,4'-DDD	0.0043	\	\	\
												4,4'-DDE	0.0023	\	\	\
												4,4'-DDT	0.0016	\	\	\
												Endosulfan I	0.0016	\	\	\
												Endosulfan sulfate	0.0058	\	\	\
												Endrin ketone	0.003	\	\	\
												gamma-BHC (lindane)	0.0013	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Heptachlor epoxide	0.00055	\	\	\
												Methoxychlor	0.01	\	\	\
												2-Butanone	0.005	\	\	\
												2-Hexanone	0.008	\	\	\
												4-Methyl-2-pentanone	0.008	\	\	\
												Acetone	0.009	\	\	\
												Chlorobenzene	0.008	\	\	\
												Chloroform	0.005 JB	\	0.005	\
												Ethylbenzene	0.002	\	\	\
												Methylene chloride	0.033 B	\	0.016	\
												Styrene	0.004	\	\	\
												Tetrachloroe-thene	0.001	\	\	\
												Xylenes (total)	0.007	\	\	\
												Contaminants that were not detected by laboratory analysis have been excluded from the above list. RAGs were exceeded for barium, chromium (total), and copper. RESRAD modeling indicates concetrations are protective of the environment.				
												Sr-90	0.046U	\	\	\
132-F-1	Laboratory	100-FR-1	67.90 m x 35.40 m	late 1940s-1977	This site was the former 141-F Chronic Feeding Sheep Barn. The building was an L-shaped concrete block building. The building was demolished in 1977. The site has been evaluated and determined to meet RAOs.	Interim Closed Out	WSRF 2006-029	09-Aug-05	25-Sep-06	3,400	1	alpha-Chlordane	0.0027	\	\	\
												beta-BHC	0.0018	\	\	\
												gamma-Chlordane	0.0034	\	\	\
												2-Methylnaph-thalene	0.17	\	\	\
												Benzo(a) anthracene	0.088	\	\	\
												Benzo(a)pyrene	0.11	\	\	\
												Benzo(b) fluoranthene	0.093	\	\	\
												Benzo(g,h,i) perylene	0.039	\	\	\
												Benzo(k) fluoranthene	0.12	\	\	\
												Chrysene	0.12	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Dibenzofuran	0.044	\	\	\
												Fluoranthene	0.11	\	\	\
												Indeno(1,2,3-cd)pyrene	0.043	\	\	\
												Naphthalene	0.24	\	\	\
												Phenanthrene	0.068	\	\	\
												Pyrene	0.12	\	\	\
												Pyrene	0.12	\	\	\
132-F-2	Laboratory	100-FR-1	301.9 m^2	1977	The site was a laboratory that was part of the EAF. The laboratory was used for particulate exposure experiments and for a series of studies on the effects of ionizing radiation on dogs. Between 300 and 400 beagles were housed at the nearby dog kennels during the studies. The primary isotopes used for the dog studies were Pu-239 and radium-226. The 144-F animal pens were decontaminated, demolished, and buried in the 182-F Reservoir in either fiscal year 1977 or fiscal year 1978. The 144-F Building was decontaminated, demolished, and buried in the 183-F Clearwells during fiscal year 1979.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
132-F-3	Burial Ground	100-FR-1	51.21 m x 29.87 m	1943-1965	This site is the former 115-F Gas Recirculation Facility, which was demolished and disposed in-place and covered with 1.2 m (3.9 ft) of clean backfill in 1984. Using the greatest activities from the characterization data from the original decommissioning activities to represent residual contamination levels over 100 percent of the inner surface area of the former facility, RESRAD modeling was performed in 2003 to support the previous decision to demolish and bury the facility in place. The RESRAD modeling predicts that the site achieves the dose limits and risk objective for rural residential land use, groundwater protection, and river protection.	No Action	WSRF 2003-25	01-Jul-84	01-Oct-84	N/A	N/A	Tritium	570	\	\	\
												C-14	8400	\	\	\
												Co-60	20	\	\	\
												Sr-90	16	\	\	\
												Cs-137	120	\	\	\
												Eu-152	7	\	\	\
												Eu-154	4	\	\	\
												Eu-154	4	\	\	\
132-F-4:2 (subsite)	Burial Ground	100-FR-1	8.2 octagon	1944-1965	The 116-F Reactor Stack Base was buried in place. The 5.3 m (17.3 ft) high octagon-shaped stack base had an additional 1.8 m (5.9 ft) high octagon-shaped foundation. The base includes a 15 cm (5.9 in.) diameter drain pipe ran east from the stack base to the 105-F Building. External piping and the upper 1 m (3.3 ft) of internal piping were removed during the demolition of the 116-F stack and 105-F Building walls. Cast iron pipe remains imbedded in the stack base, but the potential contamination is deemed negligible. The site was reclassified No Action based on a RESRAD analysis of the stack residual contamination as a worst case scenario.	No Action	WSRF 2005-043	N/A				C-14	6	\	\	\
132-F-5	Burial Ground	100-FR-1	16.76 m x 7.01 m	1960-1965	This site is the former 117-F Filter Building, which was demolished in 1983. The rubble was buried in-place under at least 1 m (3.3 ft) of clean fill. Using the greatest activities from the characterization data from the original decommissioning activities to represent residual contamination levels over 100 percent of the inner surface area of the former facility, RESRAD modeling was performed in 2003 to support the previous decision to demolish and bury the facility in place. The RESRAD modeling predicts that the site achieves the dose limits and risk objective for rural residential land use, groundwater protection, and river protection.	No Action	WSRF 2003-29	01-Nov-83	01-Nov-83	N/A	N/A	Sr-90	10	\	\	\
												Co-60	8	\	\	\
												Cs-137	8	\	\	\
												Eu-152	37	\	\	\
												Eu-154	5	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL Deep[b]
132-F-6	Pump Station	100-FR-1	15.24 m x 15.24 m	Not Documented	This site is the former 1608-F Facility, which was a lift station to pump effluent to the 107-F Retention Basin. The facility was demolished and buried in-place under at least 5 m (16.4 ft) of clean backfill. Using the greatest activities from the characterization data from the original decommissioning activities to represent residual contamination levels over 100 percent of the inner surface area of the former facility, RESRAD modeling was performed in 2003 to support the previous decision to demolish and bury the facility in place. The RESRAD modeling predicts that the site achieves the dose limits and risk objective for rural residential land use, groundwater protection, and river protection.	No Action	WSRF 2003-32	01-Aug-87	01-Aug-83	N/A	N/A	Tritium	888	\	\	\
												C-14	883	\	\	\
												Co-60	1250	\	\	\
												Sr-90	13200	\	\	\
												Cs-137	1990	\	\	\
												Eu-152	2650	\	\	\
												Eu-154	461	\	\	\
												Cs-137	0.059	\	0.036	\
141-C	Laboratory	100-FR-1	35.40 m x 6.10 m	1952-1976	The site was the former large animal barn and biology laboratory. Primary isotopes used in experimentation were I-131, Sr-90, Cs-137, Ru-106, and Pu-239.	Interim Closed Out	WSRF 2006-027	9/1/2004 (confirmatory sampling) remediation activities not dated.	30-Jan-06	900 bank cubic meters	1	Sr-90	1.7	\	0.49	\
												Arsenic	7.7	\	3.5 (<BG)	\
												Barium	135	\	106 (<BG)	\
												Beryllium	0.39	\	0.35 (<BG)	\
												Boron	7.4	\	5.3	\
												Chromium (total)	9.7	\	9 (<BG)	\
												Chromium (hexavalent)	1.5	\	0.6	\
												Cobalt	6.5	\	6 (<BG)	\
												Copper	14.1	\	13 (<BG)	\
												Lead	22.9	\	10.4	\
												Manganese	364	\	318 (<BG)	\
												Mercury	0.03	\	\	\
												Nickel	10.6	\	10 (<BG)	\
												Vanadium	45.7	\	38.6 (<BG)	\
												Zinc	65.3	\	47.8 (<BG)	\
												Anthracene	0.065	\	\	\
												Benzo(a) anthracene	0.15	\	0.05	\
												Benzo(a)pyrene	0.16	\	0.05	\
												Benzo(b) fluoranthene	0.11	\	0.04	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Benzo(g,h,i) perylene	0.099	\	0.14	\
												Benzo(k) fluoranthene	0.076	\	\	\
												Chrysene	0.2	\	0.06	\
												Dibenz(a,h) anthracene	0.024	\	\	\
												Fluoranthene	0.4	\	0.15	\
												Fluorene	0.03	\	\	\
												Indeno(1,2,3-cd)pyrene	0.11	\	0.04	\
												Phenanthrene	0.28	\	0.09	\
												Pyrene	0.44	\	0.14	\
												Antimony	1.1 (<BG)	\	\	\
1607-F1	Septic Tank	100-FR-2	6.50 m x 2.64 m	1944-1965	The 1607-F Sanitary Sewer System consists of septic tank, drain field, and pipelines. The septic tank serviced the 1201-F Gatehouse, 1709-F Fire Station, and 1720-F Administration Office.	Interim Closed Out	WSRF 2004-130	08-Jan-07	13-Aug-08	464	3.4	Arsenic	2.9	\	2.2 (<BG)	\
												Barium	90.8	\	62.6 (<BG)	\
												Beryllium	0.41	\	0.3 (<BG)	\
												Boron	2.1	\	\	\
												Chromium (total)	21.6	\	12 (<BG)	\
												Cobalt	6	\	5.6 (<BG)	\
												Copper	11.6	\	11.2 (<BG)	\
												Lead	17.5	\	7.9 (<BG)	\
												Manganese	292	\	264 (<BG)	\
												Mercury	0.16 (<BG)	\	\	\
												Molybdenum	0.52	\	\	\
												Nickel	9.8	\	8.8 (<BG)	\
												Selenium	1.4	\	\	\
												Silver	0.51 (<BG)	\	\	\
												Vanadium	35.7	\	33.1 (<BG)	\
												Zinc	49.4	\	37.7 (<BG)	\
												Total petroleum hydrocarbons	253	\	\	\
												Bis(2-ethylhexyl) phthalate	0.27	\	0.12	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Dibenz(a,h) anthracene	0.029	\	\	\
												Fluoranthene	0.022	\	\	\
												Phenanthrene	0.018	\	\	\
												Pyrene	0.029	\	\	\
												beta-BHC	0.0006	\	\	\
												Alpha-Chlordane	0.0042	\	\	\
												4,4'-DDD	0.0012	\	\	\
												4,4'-DDE	0.011	\	\	\
												4,4'-DDT	0.003	\	\	\
												Gamma-Chlordane	0.0025	\	\	\
												Endosulfan I	0.00053	\	\	\
												Heptchlor epoxide	0.0006	\	\	\
												Methoxychlor	0.001	\	\	\
												Groundwater RAGs were exceeded for selenium, TPHs, and 4, 4' DDE; however, RESRAD modelling indicated concentrations were protective of the environment.				
												Cs-137	0.25	\	0.16	\
1607-F2	Septic Tank	100-FR-1	11.67 m x 4.02 m	1944-1965	This former septic system, which consisted of septic tank, tile field, and associated pipeline, serviced the 184-F, 190-F, 105-F, 108-F, and the 1700 Administration Service Buildings. This site received unknown amounts of sanitary sewage.	Interim Closed Out	CVP-2002-00005	21-Mar-02	13-Aug-02	35,099	4.6	Co-60	0.057 U	\	0.023	\
												Eu-152	0.56	\	0.33	\
												Eu-154	0.16 U	\	0.066	\
												Eu-155	0.11 U	\	0.049	\
												Cs-137	0.14	\	0.067 (<BG)	\
1607-F3	Septic Tank	100-FR-1	4.82 m x 1.88 m	1944-1965	This site is the former location of the sanitary sewer system that supported the 182-F Pump Station, the 183-F Water Treatment Plant, and the 151-F Substation.	Interim Closed Out	WSRF 2006-047	01-Sep-05	18-Dec-06	6,589	4	Arsenic	15.2	\	8.2	\
												Barium	81.8	\	73.3 (<BG)	\
												Beryllium	0.29	\	0.26 (<BG)	\
												Boron	0.67	\	0.38	\
												Cadmium	0.46 (<BG)	\	\	\
												Chromium (total)	10.3	\	9.6 (<BG)	\
												Cobalt	6.7	\	6.0 (<BG)	\
												Copper	14.7	\	13.2 (<BG)	\
												Lead	47.3	\	29	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
												Manganese	294	\	275 (<BG)	\
												Mercury	0.04 (<BG)	\	\	\
												Nickel	10.9	\	10.2 (<BG)	\
												Selenium	4.2	\	\	\
												Vanadium	37.4	\	34.1 (<BG)	\
												Zinc	52.1	\	41.9 (<BG)	\
												Aroclor-1260	0.0035	\	\	\
												Alpha-Chlordane	0.001	\	\	\
												Gamma-Chlordane	0.0026	\	\	\
												Benzo(a)pyrene	0.033	\	\	\
												Benzo(g,h,i) perylene	0.023	\	\	\
												Benzo(k) fluoranthene	0.029	\	\	\
												Chrysene	0.022	\	\	\
												Di-n-butylphthalate	0.025	\	\	\
												Indeno(1,2,3-cd)pyrene	0.022	\	\	\
												Ethylbenzene	0.002	\	\	\
												Methylene Chloride	0.043	\	\	\
												Tetrachloroethene	0.002	\	\	\
												Toluene	0.001	\	\	\
												Xylenes (total)	0.006	\	\	\
													Excavation	Road X-ing	Excavation	Road X-ing
1607-F4	Septic Tank	100-FR-1	1.62 m x 1.01 m	1944-1965	The site includes the former location of a sanitary sewer system that serviced the 115-F Gas Recirculation Building. The site received unknown amounts of sanitary sewage.	Interim Closed Out	WSRF 2004-131	03-Apr-07	07-Aug-07	707	3.2	U-233/234	\	0.489 (<BG)	\	\
												U-238	\	0.458 (<BG)	\	\
												Antimony	1.2	\	0.83 (<BG)	\
												Arsenic	2.8	1.4 (<BG)	2.2 (<BG)	\
												Barium	84.8	29.6 (<BG)	68.1 (<BG)	\
												Beryllium	0.43	0.27 (<BG)	0.34 (<BG)	\
												Cadmium	0.38 (<BG)	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												Chromium (total)	29.6	7.0 (<BG)	13.2 (<BG)	\
												Cobalt	7.8	4.5 (<BG)	6.9 (<BG)	\
												Copper	21.7	13.6 (<BG)	14.7 (<BG)	\
												Chromium (hexavalent)	0.23	\	\	\
												Lead	6.8	3.4 (<BG)	5.5 (<BG)	\
												Manganese	351	218 (<BG)	312 (<BG)	\
												Mercury	1.2	\	\	\
												Molybdenum	0.58	0.49	\	\
												Nickel	12.7	9.5 (<BG)	10.1 (<BG)	\
												Vanadium	47.8	27.3 (<BG)	43 (<BG)	\
												Zinc	93	30.8 (<BG)	48.7 (<BG)	\
												Aroclor-1254	0.046	\	\	\
												Aroclor-1260	0.0067	\	\	\
												alpha-Chlordane	0.0056	\	\	\
												4,4'-DDE	0.0021	\	\	\
												4,4'-DDT	0.0028	\	\	\
												gamma-Chlordane	0.0045	\	\	\
												Endrin aldehyde	0.0018	\	\	\
												Endrin ketone	0.0029	\	\	\
												Benzo(a) anthracene	0.022	\	\	\
												Benzo(k) fluoranthene	0.018	\	\	\
												Bis(2-ethylhexyl) phthalate	\	0.19	\	\
												Chrysene	0.026	\	\	\
												Di-n-butylphtha-late	0.05	0.041	0.031	\
												Fluoranthene	0.044	\	\	\
												Phenol	0.029	\	\	\
												Pyrene	0.038	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
												RAGs were exceeded in the excavation samples for mercury, Aroclor-1254, benzo(a)anthracene, and benzo(k)fluoranthracene; however, RESRAD analogous site modeling indicated concentrations were protective of the environment.				
												Arsenic	2.9 (<BG)	\	\	\
1607-F5	Septic Tank	100-FR-1	1.62 m x 1.01 m x 2.74 m	1944-1965	The site is a former septic tank, tile field, and associated pipeline that received sewage from the 181-F Pumphouse. The septic tank had a capacity of 795 L (210 gal).	Interim Closed Out	WSRF 2006-043	30-Aug-05	20-Mar-06	2250	2.8	Barium	65.6	\	45.6 (<BG)	\
												Beryllium	0.22	\	0.2 (<BG)	\
												Boron	0.53	\	\	\
												Chromium (total)	9.8	\	8.9 (<BG)	\
												Cobalt	5.2	\	4.7 (<BG)	\
												Copper	16.3	\	13.5 (<BG)	\
												Lead	7.5	\	4.3 (<BG)	\
												Manganese	254	\	217 (<BG)	\
												Molybdenum	0.53	\	\	\
												Nickel	11.6	\	10.2 (<BG)	\
												Vanadium	29.6	\	28 (<BG)	\
												Zinc	39.5	\	29.6 (<BG)	\
												Bis(2-ethylhexyl) phthalate	0.31	\	0.11	\
												Di-n-butylphthalate	0.11	\	\	\
												C-14	0.9U	\	0.64	\
1607-F6	Drain/Tile Field	100-FR-1	22.86 m x 4.88 m	1945-1975	The site is located in the EAF area of the 100-F Area and received sanitary sewage from area buildings. A portion of the septic system drainfield is located directly over one of the large reactor cooling water effluent pipelines.	Interim Closed Out	CVP-2001-00010	28-July-00	16-Jan-01	1726	3.5	Cs-137	0.089J	\	0.056	\
												Co-60	0.053U	\	0.021	\
												Eu-152	0.065J	\	0.054	\
												Eu-154	0.18U	\	0.072	\
												Eu-155	0.11U	\	0.044	\
												Ni-63	0.21U	\	0.12	\
												Sr-90	0.066U	\	0.03	\
												Lead	18.5	\	12	\
												Aroclor-1254	0.41	\	0.21	\
												RAGs were exceeded for lead and Aroclor-1254; however, RESRAD analogous site modeling indicated concentrations were protective of the environment.				
												Antimony	0.53 (<BG)	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
1607-F7	Septic Tank	100-FR-1	1.52 m x 1.52 m x 1.83 m	1945-1975	The site was a former animal grazing area above a septic tank, tile field, and associated pipeline. The septic tank received sewage from 141-M Building and had a volume of 3,800 L (1,000 gal).	Interim Closed Out	WSRF 2006-040	08-Aug-05	04-Apr-06	1088	3.6	Arsenic	3.7	\	2.7 (<BG)	\
												Barium	135	\	113 (<BG)	\
												Beryllium	0.46	\	0.4 (<BG)	\
												Boron	4.7	\	4.5	\
												Cadmium	0.32	\	0.17 (<BG)	\
												Chromium (Total)	18.7	\	11 (<BG)	\
												Cobalt	6.5	\	5.7 (<BG)	\
												Copper	15.3	\	13.7 (<BG)	\
												Lead	46.3	\	18.9	\
												Manganese	321	\	283 (<BG)	\
												Mercury	0.02 (<BG)	\	\	\
												Molybdenum	0.52	\	0.48	\
												Nickel	10.5	\	9.9 (<BG)	\
												Vanadium	36.8	\	32.2 (<BG)	\
												Zinc	84	\	48.8 (<BG)	\
												Aroclor-1254	0.0084	\	\	\
												Aroclor-1260	0.01	\	\	\
												2-Methylnaph-thalene	0.39	\	0.16	\
												Benzo(a) anthracene	0.026	\	\	\
												Benzo(a)pyrene	0.023	\	\	\
												Benzo(b) fluoranthene	0.048	\	\	\
												Benzo (g,h,i) perylene	0.058	\	\	\
												Benzo(k) fluoran-thene	0.046	\	\	\
												Bis(2-ethylhexyl) phthalate	0.066	\	0.05	\
												Butylbenz-ylphthalate	0.037	\	\	\
												Chrysene	0.078	\	\	\
												Diben-zofuran	0.03	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
												Di-n-butylphtha-late	0.77	\	0.31	\
												Fluoran-thene	0.072	\	\	\
												Indeno-(1,2,3-cd) pyrene	0.058	\	\	\
												Naph-thalene	0.39	\	0.21	\
												Phenanthrene	0.39	\	0.21	\
												Pyrene	0.071	\	\	\
												Aldrin	0.00042	\	\	\
												alpha-BHC	0.0011	\	\	\
												alpha-Chlordane	0.0017	\	\	\
												beta-BHC	0.0085	\	0.0019	\
												4,4'-DDE	0.0021	\	\	\
												4,4'-DDT	0.01	\	0.0095	\
												Acetone	0.029	\	0.011	\
												Endo-sulfan I	0.00054	\	\	\
												Endo-sulfan sulfate	0.0011	\	\	\
												Endrin aldehyde	0.0013	\	\	\
												Endrin ketone	0.00089	\	\	\
												gamma-Chlordane	0.0011	\	\	\
												Metho-xychlor	0.0014	\	\	\
												2-Hexanone	0.002	\	\	\
												4-Methyl-2-pentanone	0.003	\	\	\
												Chloroform	0.003	\	\	\
												Methylene chloride	0.011	\	\	\
												RAGs were exceeded for lead and 4,4-DDT; however, RESRAD analogous site modeling indicated concentrations were protective of the environment.				
												Antimony	0.25 (<BG)	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
182-F	Dumping Area	100-FR-1	131.67 m x 94.18 m		Site 182-F consisted of a concrete basin divided into two sections. This reservoir held reserve water for reactor cooling and had a capacity of 94.6 million L (25 million gal). The basin was later used as a landfill for the disposal of decontaminated rubble from buildings that were decommissioned in the 100-F Area. It was covered in 1997 with clean fill.	Interim Closed Out	WSRF 2005-025	29-Mar-05	29-Apr-05	Not Specified (assume stockpiles were returned to excavation).	3.96	Arsenic	7.1 (<BG)	\	\	\
												Barium	78.6 (<BG)	\	\	\
												Beryllium	0.44 (<BG)	\	\	\
												Boron	2.4	\	\	\
												Cadmium	0.39 (<BG)	\	\	\
												Chromium (total)	13 (<BG)	\	\	\
												Cobalt	6.3 (<BG)	\	\	\
												Copper	16 (<BG)	\	\	\
												Chromium (hexa-valent)	0.34	\	\	\
												Lead	19.8	\	\	\
												Mang-anese	286 (<BG)	\	\	\
												Molyb-denum	0.49	\	\	\
												Nickel	11.6 (<BG)	\	\	\
												Vanadium	40.2 (<BG)	\	\	\
												Zinc	83.7	\	\	\
												Aroclor-1016	0.02	\	\	\
												Aroclor-1254	0.11	\	\	\
												Aroclor-1260	0.023	\	\	\
												Only one sample was analyzed for the soils at the bottom of excavation. COPCs represent those contaminants present at concentrations above laboratory detection limits. RAGs were exceeded for lead, zinc, Aroclor-1016, Aroclor-1254, and Aroclor-1260; however, RESRAD modeling indicated the contaminant concentrations were protective of the environment.				
600-31	Dumping Area	100-FR-2	15.24 m x 3.05 m	Not Documented	The site is a sandy area and exhibits physical evidence that the dumping of laboratory materials took place. The area also appears to have been disturbed by a blade or bulldozer. Wastes identified are laboratory-type bottles and bottle caps. The markings and colors on the bottles and caps indicate they most likely contained laboratory chemicals (e.g., nitric acid, sulfuric acid, and hydrochloric acid). No evidence exists to indicate hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-006	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
UPR-100-F-1	Unplanned Release	100-FR-1	12.19 m x 12.19 m	1971	The site is an unplanned release that occurred on March 13, 1971. The release is associated with the 100-F-29 pipelines that were on the northeast end of the EAF hog barn, identified as the 141-C Building. The washwater contained 4 x 10^{-5} curies of Sr-90 and 1.06 x 10^{-6} curies of Pu-239. The site is located within the footprint of the 100-F-29 pipeline excavation and was therefore included as part of this CVP sample design for cleanup verification.	Interim Closed Out	CVP-2001-00003	See 100-F-19:2				Co-60	0.086	\	0.11	\
UPR-100-F-2	Unplanned Release	100-FR-1	142.04 m x 0.91 m	Not Documented	The site is a narrow ditch that was created from repeated effluent leakage at the north end of the 107-F Retention Basin. Multiple releases occurred intermittently for an extended period of time before the leak was repaired. The ditch appears today as an open cobble-covered field that cannot be distinguished from the 116-F-9 Animal Waste Leach Trench, which it crosses from west to east. The point where the ditch reaches the river is unremarkable with no clear signs of erosion.	Interim Closed Out	CVP-2001-00011	6-Feb-01	16-Aug-01	670	4.2	Cs-137	0.351	\	0.0379	\
												Eu-152	1.48	\	0.511	\
												Eu-154	0.210 U	\	0.104	\
												Eu-154	0.210 U	\	0.104	\
UPR-100-F-3	Unplanned Release	100-FR-1	3.05 m x 3.05 m	Not Documented	The site is an unplanned release that occurred at the northeast corner of the 146-FR Building. This spill became part of the 100-F-25 excavation project. The extent of the unplanned release was contained entirely within the footprint of the 100-F-25 waste site.	Interim Closed Out	CVP-2003-00010	See 100-F-25								
100-IU-2/6 Operable Unit Waste Sites																
500-100	Sanitary Landfill	100-IU-2	39.1 m x 15.24 m x 3.05 m	1850-1944	The site is an unlined excavation that received industrial, commercial, domestic, and farm wastes. The site has been bulldozed and backfilled with clean fill dirt, but some debris, including miscellaneous metal, broken glass, and pottery shards are visible on the surface.	Accepted	EPA/ROD/R10-99/039	N/A				Cs-137	0.084 (<BG)	\	N/A	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-107	Crib	100-IU-6	4.57 m x 1.22 m x 2.44 m	1944-1950	The site consisted of two small cribs located on the southwest and southeast corners of the 213-J & K Storage Vault Facility. A backhoe was used in November 1974 to excavate down to the crib structures to allow for radiological surveys and sampling of the soil and inlet piping. No contamination was found above background limits. The backhoe essentially destroyed the crib structures. The excavated material was returned to the hole and backfilled. The site has been evaluated and determined to meet RA objectives. In May 2003, confirmatory samples were collected from the two cribs. The sample results verify material at the site does not exceed the RAGs. The evaluation supports reclassification of No Action.	No Action	WSRF 2003-033	Apr-03	May-03	N/A	1.8 (characterization sampling only).	Thorium-232	0.987 (<BG)	\	N/A	\
												These COPCs represent those constituents detected above the PQL.				
600-108	Storage	100-IU-6	12.19 m x 3.66 m x 2.44 m	1944	This site, 600-108, refers to the 213-K Vault. The other half of the facility (600-257) is the 213-J Vault. The 213 facility was constructed into the south side of the base of Gable Mountain. The vaults are two parallel reinforced-concrete, earth- covered storage facilities. The vaults were originally built to store containers of processed plutonium product and waste boxes. Later, the vaults were used to store explosives and ammunition, and for seismic testing. The 213-K vault was used to store equipment in drums that had been contaminated with radioactive sodium. Both vaults have been released from radiation zone status.	Accepted	EPA/ROD/R10-99/039	N/A								
600-109	Sanitary Landfill	100-IU-6	30.46 m x 30.46 m x 6.10 m	1943 -1945	The site is found within what is currently called Gravel Pit 15. The site was bulldozed and covered with clean soil. Visible debris is widely scattered within the pit. A large pile of river rock is located in the central part of the excavation.	Accepted	EPA/ROD/R10-99/039	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-110	Sanitary Landfill	100-IU-6	6096 m x 60.96 m x 6.10 m	1850-1943	The site consisted of an unlined excavated area that had been backfilled. Research indicated that the landfill was possibly used as a canal that carried water for irrigation. Additional research noted that it operated as an unlined excavation used to dispose of typical industrial and domestic wastes from 1850 to 1943 from the original Hanford townsite. Following the site's operational use, it was backfilled with clean fill for the construction of the Hanford Construction Camp. While the site has been backfilled and covered with clean soil, some surface debris remained at the site, including oil cans, miscellaneous metal cans, and paint cans. The site reclassification to No Action decision was supported based on reviews of the site history, field observations, geophysical surveys, and the confirmatory field investigation results conducted for the RSVP.	No Action	WSRF 2004-062	Feb-03	Apr-03	N/A		Antimony	1.2 (<BG)	\	\	\
600-111	Crib	100-IU-6	2.44 m x 2.44 m x 1.52 m	1949-1951	The site includes the area where the 120 Experimental Building, the 123 Control Building (including septic system), and the P-11 Crib were located, collectively known as the P-11 Critical Mass Laboratory. The P-11 Crib received low-level plutonium waste from the 120 Building (Critical Assembly Room, Chemistry Laboratory, Storage and Tank Room, and Change Room). The 120 Building and the crib were demolished in 1974. Confirmatory sampling indicated that the septic system required remedial action. The confirmatory sampling for the remaining areas met RAGs.	Interim Closed Out	WSRF 2004-065	25-Feb-08	21-April-08	2755	4.6	Arsenic	7	\	5.6 (<BG)	\
												Barium	170	\	154	\
												Beryllium	1.1	\	0.97 (<BG)	\
												Boron	1.2	\	\	\
												Chromium (total)	12.7	\	11.6 (<BG)	\
												Cobalt	11.6	\	10.6 (<BG)	\
												Copper	26.5	\	22.8	\
												Lead	21.4	\	12.7	\
												Mang-anese	703	\	501 (<BG)	\
												Mercury	0.030 (<BG)	\	\	\
												Molyb-denum	1.3	\	1	\
												Nickel	16	\	14.5 (<BG)	\
												Vanadium	86.5	\	75.9 (<BG)	\
												Zinc	66.7	\	61.6 (<BG)	\
												Bis(2-ethylhexyl) phthalate	0.062J	\	0.088	\
												Iso-phorone	0.02	\	\	\
												Pyrene	0.018	\	\	\
												These COPCs represent those constituents detected above the laboratory detection limits. Barium, copper and lead exceeded RAGs but RESRAD modeling indicated concentrations were protective of the environment.				

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-120	Burn Pit	100-IU-2	110 m x 65 m	1943-1948	The site is a burn pit that was used for industrial and commercial wastes (solvents, waste oils, and flammable wastes), and may have been used to dispose of other solid wastes. The site appears to have been backfilled with coal ash. Although identified as a Burn Pit, there does not seem to be evidence of material burning. The area is large and covered with what looks like coal ash.	Accepted	EPA/ROD/R10-99/039	N/A								
600-121	Dumping Area	100-IU-2	30 m x 15 m	Not Documented	The site is waste consisting of coal ash that has been placed in several piles (discernible units). The piles are located just east of the Pickling Acid Cribs. Coal used at the Hanford Site came from a single source. EP Toxicity tests and analytical assays of ash piles have found no evidence to indicate hazardous, dangerous, or radioactive waste exists at coal ash sites where no other waste disposal occurred.	Rejected	WSRF 97-039	N/A								
600-122	Depression/Pit (nonspecific)	100-IU-2	430 m x 203 m	<1943	The site appears to predate Manhattan Engineering District activities on the site and was probably an irrigation reservoir. No water remains on the surface of the depression. Natural vegetation covers the site along with several large trees. The eastern boundary of the site once was a power distribution line and powerline road. Power poles were removed by cutting them off just above the ground surface. Glass insulator material litters the area. Wood post and wire fencing surrounds this site just west of this powerline. The fence is in very poor condition.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-123	Dumping Area	100-IU-2	1.2 m x 0.9 m x 0.9 m	Not Documented	The site was a farm site littered with waste debris, including battery cores, broken glass, concrete, cans, bottles, wire, machinery parts, domestic wastes, farm debris (including sheep fencing, irrigation, and other farming equipment), scattered household debris, and foundations for buildings. Two of the building foundations are deep and open to the surface. One of these is filled with concrete rubble, piping, and debris. There is one concrete slab that could be a building foundation and one small concrete structure that is approximately 1.2 m (4 ft) by 0.9 m (3 ft) and 0.9 m (3 ft) deep. There is no evidence of hazardous material, and it is a residential, not industrial site.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-124	Burn Pit	100-IU-2	40 m x 25 m	Not Documented	The site is a burn area where there is evidence of surface burning and paint disposal. The entire area is littered with burned wood, partly burned roofing materials, glass, nails, metallic debris, transite, and isolated paint cans. There is evidence of surface disposal of paint materials in dried paint chips and deposits. There is also a large area with decaying timbers arranged in many parallel rows, which appears to be some type of floor structure.	Accepted	EPA/ROD/R10-99/039	N/A								
600-125	Trench	100-IU-2	70 m x 50 m	Not Documented	The site currently looks like a sandy depression with wood, ceramic, and metal debris on the surface. Based on a May 2004 site walkdown for suspect hazardous surface debris (e.g., presumed asbestos-wrapped pipe, oil-contaminated soil in the area of pipe turnings), an RA is necessary. The waste includes metal shavings, steel piping, plumbing fixtures, paint cans and automotive parts, as well as other metallic and wooden debris. In the same area, there are several piles of used railroad ties, broken vitrified clay pipe, concrete pipe, 30.5 cm (12 in.) diameter, 6.1 m (20 ft) long spiral welded pipe, plumbing fixtures, and degraded asbestos insulation.	Accepted	EPA/ROD/R10-99/039	N/A								
600-126	Depression/Pit (nonspecific)	100-IU-2	1.22 m	Not Documented	The site is a subsurface concrete structure that appears to be about 1.2 m (4 ft) across. Soil around the structure has subsided into its underground void space. A few feet behind is a vertical pipe that opens into the void beneath the structure. An effort was made in fall 1999 to backfill the open holes and subsidence in this area to eliminate physical hazards.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-127	Storage	100-IU-2	55 m x 35 m	Not Documented	The site is two loading docks, each approximately 20 m (65.6 ft) long by 12 m (39.3 ft) wide, and a rectangular area surrounded by a low soil berm. Several wooden beams with wooden shims are located inside the bermed area, and asr placed to suggest that they once supported four or five fuel storage tanks. The ground within the berm is covered by a layer of coal ash. Removal of small areas of the ash ground cover reveals soil discoloration and evidence of petroleum product contamination. Other small debris piles are located nearby that consist of broken vitrified clay piping, plumbing fixtures, and concrete piping. There are several locations of petroleum product-contaminated-soil associated with this site.	Accepted	EPA/ROD/R10-99/039	N/A				Arsenic	2.2(<BG)	\	N/A	\
600-128	Dumping Area	100-IU-2	2 m (diameter)	Not Documented	The site had been an oil dump area that included several canister-type oil filters. Several Hanford Site construction shops and warehouse facilities were located in this area. The material was removed to a depth of 25 cm (10 in.), sampled to support waste designation, collected and packaged in accordance with waste management plans, and removed from the site for subsequent disposal at the ERDF or other approved facilities. The remaining soils at these sites have been sampled and analyzed. The results of the evaluation demonstrated that the materials remaining at the 600-128 site do not exceed the RAGs. These results also show that residual soil concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.5 m [15 ft]) and contaminant levels remaining in the soil are protective of groundwater and the Columbia River.	Interim Closed Out	WSRF 2003-39	Apr-03	5/1/2003 (Verification Sampling Only).	Not Specified	<1 (confirmatory sampling only)	Barium	71.1(<BG)	\	N/A	\
												Cadmium	0.33(<BG)	\	N/A	\
												Chromium	10.9(<BG)	\	N/A	\
												Lead	8.6(<BG)	\	N/A	\
												Total Petroleum Hydro-carbons	176	\	N/A	\
												Bis(2-ethylhexyl) phthalate	0.17	\	N/A	\
												COPCs represent those analytes detected above PQLs. Total petroleum hydrocarbons and bis(2-ethylhexyl)phthalate concentration were below RAGs.				
												None	N/A	N/A	N/A	N/A
600-129	Dumping Area	100-IU-2	203 m x 150 m	Not Documented	The site was a pre-Manhattan Engineering District-era waste dump. The area appeared to have been used as a burn pit for flammable wastes as well as a dump. It was presumed this dump area was used by residents of White Bluffs and later by the Manhattan Engineering District to a lesser degree. The site was in a large depression and was littered with domestic and industrial debris. Industrial wastes were found at the southern edge of the site.	Interim Closed Out	WSRF 2004-136	Jul-04	Oct-07	Not Specified	0	None	N/A	N/A	N/A	N/A

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-130	Fabrication Shop	100-IU-2	270 m x 270 m	Not Documented	The site consists of remnants of the following facilities: valve box and 50 mm (2 in.) water line, concrete foundation, warehouse foundation, concrete sump attached to warehouse foundation, debris pile, foundation, potential smokestack base, and small subsidence that appear to be rotted wooden poles. The area is littered with debris. These facilities are also identified as the Stephensen's Cement Pipe Factory. Two other nearby buildings are identified on duPont drawing C-3316 as an Excess Material Warehouse and Excess Material Office. DuPont drawing C-3316 indicates that the Excess Material Warehouse and Excess Material Office were constructed by a subcontractor, which would mean that these facilities were a MED addition to the White Bluffs area rather than pre-existing facilities, as was previously thought. No known hazardous materials were used at the facility, but there is potential for lubricant materials related to equipment maintenance and repair that may have been disposed near the site of these facilities.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A				Arsenic	6	\	N/A	\
600-131	Dumping Area	100-IU-2	Not Documented	Not Documented	The site included the remnants of the Special Fabrication Shop and Warehouse, boiler house, warehouse, loading dock/well, and a water station. The site has been remediated and closed out.	Interim Closed Out	WSRF 2003-45	Apr-03	May-03	Not Specified	1.7	Barium	57.3	\	N/A	\
												Chromium	10.6	\	N/A	\
												Lead	2.7	\	N/A	\
												Cadmium	0.06	\	N/A	\
												Total Petroleum Hydrocarbons	44.8	\	N/A	\
												COPCs represent those analytes detected above PQLs. All COPC concentrations were below RAGs.				
												Arsenic	2.6 (<BG)	\	N/A	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-132	Depression/ Pit (nonspecific)	100-IU-2	165 m x 112 m	Not Documented	The site was a large open borrow pit containing scattered debris consisting of rusted cans, broken concrete, wire, and two piles of aluminum shavings. Site 600-132 shows evidence of being the borrow pit for the local area, with access ramps for trucks, ridges in the bottom where it was scraped, and piles of soil near the edges where the borrow material was scraped together before loading into trucks. On the southwest corner, at the level of the surrounding grade, was a mound of dirt with large, thick, metal pieces and partially buried pieces of yellow bricks. It is uncertain if this site or Site 600-99 is the actual location of the JA Jones 2 landfill, where some radioactive material had been buried, then excavated, disposed in the 200 Area, and the landfill backfilled to grade.	Interim Closed Out	WSRF 2003-40	Apr-03	5/2003 (confirma-tory sampling)	Not Specified	<1 (confirmatory sampling only)	Barium	59.7(<BG)	\	N/A	\
												Cadmium	0.4(<BG)	\	N/A	\
												Chromium	17.1(<BG)	\	N/A	\
												Lead	12.3	\	N/A	\
												Selenium	0.47(<BG)	\	N/A	\
												Total Petroleum Hydrocarbons	8.5	\	N/A	\
												Aroclor-1260	0.032	\	N/A	\
												Bis(2-eithyhexyl) phthalate	0.051	\	N/A	\
												Di-n-butylphthalate	0.57	\	N/A	\
												The only COPC exceeding remedial action goal is lead (12.3 mg/kg versus 10.2 mg/kg for groundwater and river protection). However, RESRAD modeling does not predict its migration into groundwater.				
600-135	Burial Ground	100-IU-2	270 m (diameter)/ 90 m x 40 m	Not Documented	This unit includes two potential waste sites. One site is called the Spare Parts Machine Shop Landfill, also known as the horseshoe pit. It was once a borrow pit that was later used as a waste disposal site. The second site is a pit oriented in the east-west direction located directly west of the Spare Parts Machine Shop Landfill. No documentation could be found to indicate the purpose of the pit. In November 1997, ERC staff removed the scattered transite siding. The only waste remaining on the site is miscellaneous nonhazardous debris.	Rejected	WSRF 97-042	N/A								
600-136	Storage	100-IU-2	Not Documented	Not Documented	The site is a warehouse area within the White Bluffs townsite. It is covered with cheatgrass with some rabbitbrush and tumbleweed growth. There is very little evidence of the former warehouse buildings except for a few pieces of wood.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-138	Maintenance Shop	100-IU-2	Not Documented	Not Documented	The site is the remains of a fumigation building. Fumigants are small, volatile molecules that become gases at temperatures above 4.4°C (40°F). The same physical properties that make fumigants highly penetrating also negate the chance that any of the pesticides remain at the site. The fumigants would have readily escaped into the atmosphere due to their small size and volatility.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A		Arsenic			2.4(<BG)	\	N/A	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-139	Dumping Area	100-IU-2	30 m x 20 m	Not Documented	The site was an area thought to be associated with an automotive repair shop. Surface debris included numerous battery caps, engine gaskets, dumped waste oils, and fragments of tail light lenses. The surface debris was removed in May 2003. The site has been remediated and interim closed out.	Interim Closed Out	WSRF 2003-41	Apr-03	May-03	Not Specified	0.41	Barium	72(<BG)	\	N/A	\
												Chromium	12(<BG)	\	N/A	\
												Lead	4.4(<BG)	\	N/A	\
												Sulfide	35.8	\	N/A	\
												Petroleum Hydrocarbons	7.9	\	N/A	\
												The COPCs represent those analytes detected above PQLs. All COPCs were present at concentrations below remedial action goals.				
600-146	Dumping Area	100-IU-6	10.06 m x 4.27 m x 3.05 m	Not Documented	The site includes a steel structure constructed of steel I-beam and L-Beams. Debris observed laying around the structure includes stainless steel pipe, metal rings, metal boxes, empty cans and wood. Two earthen berms are located just east of the metal structure. To the east of the berms is a small concrete pad approximately 1.5 to1.8 m (5 to 6 ft) square. There is a pile of lumber near the metal structures. There is a small, 5.1 to 7.6 cm (2 to 3 in.) diameter, area of discolored soil containing metal fragments and charred wood. On February 5, 2001, this site was surveyed and a metal stand was found to be contaminated. The material was bagged, labeled, and transported to the 2724-WB Radioactive Material Area where it was placed in a burial box. No other contamination was found at the site. Patrol officers walked the entire area looking for abandoned explosive devices and none were found. Based on evidence at the scene, the Patrol concluded in their Incident Report that apparently the area was used for blast testing on equipment and materials.	Accepted	Not Documented	N/A								
600-149	Military Compound	100-IU-6	554.74 m x 381.00 m	1940s -1950s	The site consists of two subsites. The Range complex included a Range House Building, Well Pump House, and four firing ranges. The second subsite consists of the berm located behind the pistol/rifle range area. Complete information on all types of ordnance used is not readily available.	Accepted	EPA/ROD/R10-99/039	N/A								
600-153	Dumping Area	100-IU-6	Not Documented	Pre-Hanford	The site is pre-Hanford Site debris, such as a metal strong box, car springs, broken dishes, barbed wire, and wood.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by ther.	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-157	Foundation	100-IU-2	Not Documented	Not Documented	The site is described as several concrete foundation pads. The buildings were probably intentionally destroyed by fire, as the ground surface is littered with charred wood, burned electrical equipment (lights, switches, conduit), and nails. Field investigation identifies approximately 15 to 20 concrete pads. During the May 1999 visit, at least 40 concrete pads were counted.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-158	Storage Tank	100-IU-2	Not Documented	Not Documented	An area of reduced vegetation, vaguely circular in shape, could be the former location of a storage tank. No evidence of a pumping station was found. The ground storage tank 378,541 L (100,000 gal.) was located adjacent to the booster pump station 4.9 m x 6 m x 3 m (16 ft x 20 ft x 10 ft). These facilities were used to handle potable water.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-159	Pump Station	100-IU-2	Not Documented	Not Documented	The well had been a concrete structure covered with a steel plate and surrounded by a light-duty steel post and orange barricade material. The well has been backfilled with grout and marked with a metal disk that reads "Well No. A8991, 699-80-39B, Abandoned 9-26-95." This site was identified and named by current and former employees and is not shown on existing maps of the area.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-160	Dumping Area	100-IU-2	Not Documented	Not Documented	The site is an area containing concrete irrigation pipe sections. The piping sections are large in diameter and not very long. The site consists of a pipe standing within a large-diameter pipe. Other debris is scattered across the nearby area.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-161	Dumping Area	100-IU-2	Not Documented	Not Documented	The site consists of two piles of plumbing debris. One pile contains ceramic plumbing fixtures and the other pile contains cast iron plumbing fixtures.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-162	Dumping Area	100-IU-2	Not Documented	Not Documented	The site consisted of two debris remnants: two 0.2 m (8 in.) steel pipe sections embedded in concrete and a bucket of what appeared to be lead, which was removed in 1995.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-163	Laboratory	100-IU-2	Not Documented	Not Documented	The facility was reportedly used as the quality control test and training facility for welders who worked in the White Bluffs Main Pipe Fabrication Shop. The vague outline of a building footprint was identified at this location.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-164	Trench	100-IU-2	Not Documented	Not Documented	The earthen berm appeared to have been some of the material removed from the trench excavation. No records related to either the berm or the trench could be located.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-165	Valve Pit	100-IU-2	1 m x 1 m	Not Documented	The site is a subsidence of about 1 m^2 (3.2 ft^2) and is lined with concrete, suggesting a valve box or drain system. The subsidence indicates a subsurface structure with a void space that allows overburden to subside into it because of storm runoff. A section of power pole extends across the top of the structure. Sites 600-126, 600-166, 600 to 165, and 600 to 170 all appear to be part of a related underground piping system, such as a sewer system, stormwater collection system, or irrigation system.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-166	Depression/Pit (nonspecific)	100-IU-2	Not Documented	Not Documented	The site is a series of subsidence. One measuring approximately 4 m (13 ft) in size was originally identified in BHI-00448. A RARA Walkdown visit in May 1999 identified three additional, similar subsidence, two of which are in line with the original one. The subsidence found in 1999 measured approximately 1.83 m (6 ft) across and 0.9 m (3 ft) deep.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-167	Catch Tank	100-IU-2	3.00 x 7.08	Not Documented	The site is a large pre-MED concrete cistern. The top of the concrete cistern structure is located slightly below grade level. The hole is almost filled with windblown tumbleweeds. A small portion of the concrete structure was visible on a 1999 site visit. The cistern was used to store water (not wastewater).	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-168	Depression/Pit (nonspecific)	100-IU-6	N/A	Not Documented	The site contains a number of toilet pits (outhouse pits) that remain open. The toilet pits were described as being located between the house foundation and the road to the south. Several hazards are found near this site, including the house foundation, a wood-lined pit on the north side of the foundation, and the former well or pump house near the south side of the site.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-169	Trench	100-IU-6	50 m x 10 m x 2 m	N/A	The site is three trenches located south of the Hanford Construction Camp, along the gravel road that is an extension of Avenue A. Each trench runs northwest to southeast and parallels the road. Spoil piles are pushed to the west side of the trenches; their purpose is unclear. A 1997 site visit observed a pile of broken concrete between the southernmost trench and the adjacent trench.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-170	Sump	100-IU-2	1.83 m x 1.83 m x 0.91 m	N/A	The site is a series of subsurface concrete structures. BHI-00448originally described a single subsurface concrete structure, possibly a sump. A RARA Walkdown visit in May 1999 found four additional similar concrete structures/subsidence surrounding an old building footprint.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-171	Office	100-IU-2	N/A	N/A	The site is the White Bluffs townsite located near the intersection of Route 2 North and Federal Avenue. Most of the buildings have been demolished except for the White Bluffs Bank. See subsite for individual facility descriptions within the townsite. These subsites include: 600-171:1, White Bluffs Townsite Wells; 600-171:2, White Bluffs Townsite Insulation Warehouse, Site Number 32; 600-171:3, White Bluffs Townsite, Office Equipment Warehouses, Site Number 33; 600-171:4, White Bluffs Townsite Elevated Water Storage Tank, Site Number 34; 600-171:5, White Bluffs Townsite Air and Welding Tool Maintenance Building, Site Number 36; 600-171:6, White Bluffs Townsite Fire Station, Site Number 37; 600-171:7, White Bluffs Townsite Service Division Engineer Office, Site Number 38; 600-171:8, White Bluffs Townsite Government Checkers and Ration Office, Site Number 39; 600-171:9, White Bluffs Townsite Two Stationary Storage Warehouses, Site Number 42; 600-171:10, White Bluffs Townsite Fire Inspection Office, Site Number 43; and 600-171:11.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-172	French Drain	100-IU-2	N/A	N/A	The site is either a French drain or dry well that is a 61 cm (24 in.) concrete pipewith a steel lid, and appears to be about 1 m (1 yd) deep. The sides are perforated, indicating that its purpose may have been for storm runoff or steam condensate. There does not appear to be an inlet pipe inside the structure. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-015	N/A								
600-173	Dumping Area	100-IU-2	60 m x 40 m	N/A	The site is a domestic type waste dump and pre-Manhattan Engineering District building foundations. The waste dump consists of miscellaneous debris and the building foundations appear to be pre-Manhattan Engineering District. One building appears to have been a garage or farm shop because of the way the concrete was formed.	Rejected	WSRF 97-016	N/A								
600-174	French Drain	100-IU-2	N/A	N/A	The site is a 61 cm (24 in.) vitrified clay pipe French drain. The top is flush with the surface and it is filled with rocks. The French drain may have been used to dispose of steam condensate. Steam condensate is nondangerous and nonradioactive.	Rejected	WSRF 97-017	N/A								
600-175	Drain/Tile Field	100-IU-2	40 m x 30 m	N/A	The site is three large depressions thought to be the original drain field for wastewater generated at the ice house. However, it is unknown if this site was used for the disposal of any other wastes or used for any other purpose. The site was originally marked by a steel post and wooden rail fence that can still be found around much of the site.	Rejected	WSRF 97-018	N/A								
600-176	Dumping Area	100-IU-2	6.10 m x 6.10 m	N/A	The site is a dumping area where it appears that excess paint materials were disposed by pouring them on the ground. The ground has dried paint chips on the surface. The paint spills and chips are scattered over a large area. Samples of the surface paint chips were collected and a shovel was used to collect a subsurface sample. The paint color in the soil extended more than a 0.3 m (1 ft) below the surface, A backhoe was used to dig deeper.	Accepted	EPA/ROD/R10-99/039	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-177	Dumping Area	100-IU-2	95 m x 45 m	N/A	The site consists of two areas in proximity. The pipe bender is a large heavy-walled pipe drilled with several holes of varied sizes, placed vertically in the ground with approximately 1.2 m (3.9 ft) of the pipe extending above grade. Adjacent to the pipe bender is a large area of debris that appears to have been a miscellaneous equipment dumping/storage area. Random dumping of small quantities of oils also occurred in the area. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-019	N/A								
600-178	Depression/Pit (nonspecific)	100-IU-6	N/A	N/A	The site is a toilet pit opening within a 4.3 by 4.9 m (14 by 16 ft) concrete pad that is the remains of the guard house. Apparently, the opening is to a sanitary sewage pit located beneath the pad. No evidence of a sewage distribution system (septic tank) is apparent. DOE/RL-94-61, Appendix N, designated the cleanup action of this site to be "Regulated under other authorities," which for uncontaminated septic systems is the Washington Department of Health.	Accepted	DOE/RL-94-61, Appendix N	N/A								
600-179	Burial Ground	100-IU-2	N/A	1943	The site is the remains of the Priest Rapids Ice House that was demolished in situ in 1975. Repairs were made immediately to the facility after acquisition by the government to supply ice and cold storage facilities for the growing work force during construction. When the plant was no longer needed by construction forces, it was turned over to the Area Engineer in a permanent standby condition. The facilities were demolished in 1975 and buried in situ by plant forces as part of a program to eliminate public nuisances. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-020	N/A								
600-180	Maintenance Shop	100-IU-2	N/A	N/A	The site is described as the remains of what appears to have been an automotive repair shop. The waste may have been solvents, grease, antifreeze, oils, and gasoline. Concern was expressed by EPA because of the types of materials usually found at an automotive repair shop. However, there is no evidence of this type of disposal.	Rejected	WSRF 97-021	N/A					Arsenic	3(<BG)	\	N/A	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-181	Dumping Area	100-IU-2	17 m x 15 m	Not Documented	The site was an oil dumping area. The area where large quantities of oil were dumped created a hard, asphalt-like layer on the ground surface. The oil material was excavated and removed in May 2003. Samples of the underlying soil were collected. In accordance with the evaluation, the cleanup verification results from samples of underlying soil support the interim closure of the site.	Interim Closed Out	WSRF 2003-048	Apr-03	May-03	Not Specified	0.3	Barium	98.1(<BG)	\	N/A	\
												Cadmium	0.12(<BG)	\	N/A	\
												Chromium	14.6(<BG)	\	N/A	\
												Lead	4.5(<BG)	\	N/A	\
												Petroleum Hydrocarbons	9.2	\	N/A	\
												The COPCs represent those analytes detected above PQLs. Petroleum hydrocarbons were present at concentrations below the most restrictive remedial action level.				
600-182	Dumping Area	100-IU-2	N/A	Not Documented	The site is excess piping materials and an area of highly degraded piping insulation that appears to be made of asbestos or a similar material. Several 6.1 m (20 ft) sections of 30.5 cm (12 in.) spiral welded steel pipe are nearby as well as other small debris piles of broken vitrified clay piping, plumbing fixtures, and concrete piping.	Accepted	Not Documented	N/A								
600-183	Dumping Area	100-IU-2	N/A	Not Documented	The site is a burn pile and debris dumping area. Within the site is one area consisting of a burn pile of domestic type debris. The other area consists of 19 L (5 gal) military-type drums. The waste consists of miscellaneous debris, including domestic type debris and military drums. It is unknown if any hazardous materials remain. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-022	N/A								
600-184	Septic Tank	100-IU-2	N/A	Not Documented	The site is a concrete box with a metal lid. It is about 0.61 m (2 ft) deep and is dry inside. The site is the various components of a septic system serving the central area of the White Bluffs townsite. In the rehabilitation of existing buildings containing inside toilets and plumbing facilities, whenever possible, connections were made to permanent systems (HAN-10970). The White Bluffs townsite had one septic tank and 91 m (300 ft) of sewer line. During field surveillance activities, a sewer junction box consisting of a shallow concrete box with a heavy steel cover was located within the confines of the townsite. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-023	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-185	Trench	100-IU-6	N/A	1943-1945	The site is described as a dumping and cleaning station for the portable toilets used at the various Hanford construction sites. Site personnel recall that wooden platforms were located there for purposes of dumping and cleaning. The unit received portable toilet cleaning chemicals and human waste. In 1998, wood debris is still visible at this location. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-034	N/A								
600-186	Trench	100-IU-6	70.10 m x 24.38 m x 1.22 m	1944	This waste site includes all the septic tanks as well as the sewage treatment plants at the Hanford Construction Camp. These facilities consisted of 80 septic tanks and 3 waste treatment plants, in addition to an unspecified number of septic tanks and drain fields that predate the construction camp but were used for camp purposes, three former sewage treatment plant sites were identified from basins that remain at the sites. Each included a system of septic tanks and a waste treatment facility, connected by 10.2 to 76.2 cm (4 to 30 in.) vitrified clay or concrete pipe. Septic tanks were standard design, three-pass baffle, wooden box type. Some tanks were quite large and a significant potential for surface collapse may exist at these sites.	Accepted	DOE/RL-94-61, Appendix N	N/A								
600-188	Trench	100-IU-2	90 m x 40 m	N/A	The site is an open trench with industrial wastes filling about one-third of the site. There is evidence of chemical or oil dumping and burning along the east side of the trench. BHI-00448 states the evidence includes discolored soils and empty 208 L (55 gal) drums that are bulging, as if the contents had been burned within the drums. During the April 1999 visit, three empty 208 L (55 gal) drums were observed, butonly one appeared to be bulging. The drums are concentrated near the eastern edge of the site. The chemical or oil dumping and burning appears to have been confined to the area around these drums. The site is a borrow pit that received discarded construction- and shop-related debris, some of which may contain constituents exceeding cleanup criteria. Therefore, the recommendation for the site is remediation to evaluate and remove surface debris.	Accepted	EPA/ROD/R10-99/039	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL Deep[b]
600-189	French Drain	100-IU-2	N/A	N/A	The site is three French drains associated with a large warehouse and temporary construction facility. The area near the French drains is littered with debris and patches of gravel. There is no oil-stained soil or other indication of hazardous waste disposal at or near the French drains. No documentation has been found describing the purpose of the drains. French drains were used for disposal of liquid wastes and these may have been used for wastewater and/or stormwater.	Rejected	WSRF 97-043	N/A				Arsenic	2.5(<BG)	\	N/A	\
600-190	Dumping Area	100-IU-2	N/A	N/A	The site has been remediated and interim closed out. The site was an area where tar and/or paints appeared to have been dumped. A review of a 1948 aerial photograph indicates this site was not the location of a facility, but a surface-scarred, vegetation-free area associated with the demolished American Pipe Company buildings. A 1944 duPont warehouse was nearby. No known Hanford Site related activities were located in this area after the warehouses were removed.	Interim Closed Out	WSRF 2003-47	Apr-03	May-03	Not Specified	0.25	Barium	81.5(<BG)	\	N/A	\
												Cadmium	0.12(<BG)	\	N/A	\
												Chromium	13.8(<BG)	\	N/A	\
												Lead	10.8	\	N/A	\
												Cyanide	0.43	\	N/A	\
												Sulfide	24.6	\	N/A	\
												Total Petroleum Hydrocarbons	24.8	\	N/A	\
												Aroclor-1254	1.1	\	N/A	\
												Aroclor-1260	0.13	\	N/A	\
												Acenaphthylene	0.038	\	N/A	\
												Anthracene	0.047	\	N/A	\
												Benzo (a) pyrene	0.062	\	N/A	\
												Benzo (b) fluoranthene	0.052	\	N/A	\
												Benzo (g,h,i) perylene	0.13	\	N/A	\
												Benzo (k) fluoranthene	0.044	\	N/A	\
												Bis(2-ehtylhexyl) phthalate	2.4	\	N/A	\
												Chrysene	0.053	\	N/A	\
												Di-n-butylphtha-late	16	\	N/A	\
												Indeno(1,2,3-cd) pyrene	0.057	\	N/A	\
												Naphthalene	0.1	\	N/A	\
												Pyrene	0.047	\	N/A	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
												COPCs represent those constituents detected above the PQL. The remaining COPCs were detected below remedial action goals with the exception of lead, Bis(2-ethylhexyl)phthalate, PCBs (Aroclor-1254 and 1260) . However, the four contaminants are relatively immobile and are not predicted to migrate into groundwater within a 1,000-year assessment period based on generic site RESRAD input parameters and modeling.				
												None	N/A	N/A	N/A	N/A
600-191	Dumping Area	100-IU-2	305 m x 80 m	Not Documented	The site has been remediated and interim closed out. The site was an area littered with miscellaneous trash and debris, including a few full 19 L (5 gal) cans of grease that were dumped on the ground in the southern section of the site. It also appears that some burning did occur at this location, but to a much smaller degree than at the White Bluffs Pre-Manhattan Engineering District Community Dump Site 1. Because of the large number of oil cans found at the site, it was believed that the site was used by both Manhattan Engineering District and White Bluffs residents for the disposal of domestic waste materials.	Interim Closed Out	WSRF 2004-136	Jul-04	Oct-07	Not Specified	0	None	N/A	N/A	N/A	N/A
600-192	Maintenance Shop	100-IU-6	N/A	Not Documented	The site is the remains of a fumigation building. The same physical properties that make fumigants highly penetrating also negate the chance that any of the pesticides remain at the site. The fumigants would have readily escaped into the atmosphere due to their small size and volatility.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-193	Storage Tank	100-IU-2	7 m x 5 m	1942-1975	The site is located in a shallow depression with heavy tumbleweed and cheatgrass growth. Prior to November 1997, the depression had been marked with a steel post and chain barrier and posted with two "DANGER KEEP AWAY" signs. The site is the location of the White Bluffs Gas Station that was demolished in 1975 as part of a sitewide cleanup project. No documentation can be found to determine if any underground storage tanks were removed. A depressed area was identified in 1989 and surrounded with steel posts and chain. A field reconnaissance was conducted on October 6, 1997. It was concluded that available evidence was insufficient to establish that an underground tank was present at the site. It was also agreed that the corner posts, chain, and signs should be removed. These items were removed in November 1997.	Rejected	WSRF 97-025	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-194	Fabrication Shop	100-IU-2	76.2 m x 48.77 m	N/A	The site is the remnants of a pipe fabrication shop. Waste materials observed at the site include wood, coal, metal, metal lathe turnings, pipe, nails, brick, and concrete. The Main Pipe Fabrication Shop was used to prepare piping systems for the reactor areas. The pipe was prepared for welding by grinding, etching with acid (pickling), and then cleaning with solvent materials. This shop was the source of waste discharged to the White Bluffs Pickling Acid Cribs (600-106). No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-026	N/A								
600-195	Electrical Substation	100-IU-2	7 m x 7 m	N/A	The site is the location of a demolished substation that serviced the White Bluffs townsite. Process knowledge of similar facilities indicates that the transformers located at the site may have contained PCBs. It is possible that dielectric oil may have leaked, been spilled, or have been intentionally released to the soil beneath the transformers. However, there is no direct evidence of a release to the soil at the site.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-196	Dumping Area	100-IU-2	170 m x 80 m	Not Documented	The site is areas of randomly scattered debris and a pit. The debris includes cans, bottles, barbed wire, and car parts scattered along the west side of a dirt road. The pit is a fairly large excavation on the east side of the road and shows no evidence of being used as a waste site. The purpose of the pit is unknown.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-198	Foundation	100-IU-2	5.03 m x 5.03 m	Not Documented	The site is a box-shaped concrete structure partially buried in the river bank. The site appears to have slid partially down the bank. The structure is filled with dirt and debris. A large quantity of 0.635 cm (0.25 in.) nylon tubing is hanging around and in the structure. Four steel pipes extend from each corner of the box. An electrical conduit also extends from the box.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-199	Dumping Area	100-IU-2	25 m x 15 m	Not Documented	The site is a concrete foundation pad that is completely covered with coal ash. The original purpose of the pad is unknown. Analytical sampling has been performed at an analogous site. The samples from the 126-D-1 Ash Pit found no evidence to indicate hazardous, dangerous, or radioactive waste exists.	Rejected	WSRF 97-044	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-20	Depression/Pit (nonspecific)	100-IU-6	3 m x 3 m	Not Documented	The site was originally described as two abandoned asphalt tanks, each with a volume capacity of 45,420 to 52,990 L (12,000 to 14,000 gal). A 1999 waste site walkdown identified several valve pits and a depression that contains discarded asphalt material, several pails, and drums. In 1997, the site was reclassified to rejected status on the WIDS database, based on the information that there was no evidence of hazardous or radiological waste was in the area.	Rejected	WSRF 97-030	N/A								
600-200	Septic Tank	100-IU-2	N/A	Not Documented	The site is a large septic tank thought to have been associated with the Priest Rapids Ice House. It is possible that this tank was used for the disposal of wastewater from the Priest Rapids Ice House and then drained to the shallow depression south of the Pickling Acid Cribs. It was once thought that pickling acid wastes may have been routed through this tank system; however, GPR indicated that this is unlikely.	Rejected	WSRF 97-027	N/A								
600-201	Dumping Area	100-IU-2	25 m x 15 m	Not Documented	In May 2003, a Test Pit was dug at an area of anomaly found with GPR. The Test Pit revealed a flattened steel bucket and some decaying wood. Field screening was done on all debris removed from the pit to determine if a sample needed to be collected. No hazardous material was found. No samples were collected from the pit. The debris was put back into the excavation. A single sample of hardened paint was collected. The site has been evaluated to confirm that it does not require remediation.	No Action	WSRF 2003-38	May-03	May-03	N/A						
600-202	Burn Pit	100-IU-6	300 m x 150 m x 12 m	Not Documented	The site includes four burn and burial pits located proximallyand arranged to form a single rectangle that lies in the northwest to southeast direction. The waste is miscellaneous trash and debris and includes such items as fire-cracked rock, glass, china, jars, bottles, metal, kitchen materials, broken toilet bowl, and other materials. It is likely that paints and solvents were burned in the pits. Bulldozer marks suggest that debris was covered, and there are extensive signs of burning over the site.	Accepted	EPA/ROD/R10-99/039	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-203	French Drain	100-IU-2	N/A	Not Documented	The site is two French drains and what appears to be a valve box. No additional information is known. A RARA Walkdown visit done in May 1999 found an additional small subsidence near the valve box and noticed a long narrow area of disturbed vegetation that may indicate these structures were part of an old irrigation system. A third French drain was also observed and mapped as a new component of this site. It is believed the site received steam condensate. Steam condensate is nondangerous and nonradioactive.	Rejected	WSRF 97-028	N/A				Arsenic	2.7(<BG)	\	N/A	\
600-204	Burn Pit	100-IU-6	150 m x 20 m x 4 m	Not Documented	The site has been remediated and interim closed out. The site was a long, narrow trench that was used as a burn pit. The area was used for dumping and burning trash. The trash was miscellaneous debris, including metal and glass fragments, nails, fire-scarred rock, cans, and bottles.	Interim Closed Out	WSRF 2003-43	Apr-03	May-03	Not Specified	0.25	Barium	166	\	N/A	\
												Cadmium	0.08(<BG)	\	N/A	\
												Chromium	10.8(<BG)	\	N/A	\
												Lead	27.7	\	N/A	\
												Petroleum Hydrocarbons	41.2	\	N/A	\
												COPCs represent those analytes detected above PQLs. COPC concentrations were below remedial action goals with the exception of lead (27.2 versus 10.2) and barium(166 versus 132). RESRAD modeling indicated the concentrations of lead and barium were protective of groundwater.				
600-205	Dumping Area	100-IU-6	N/A	<1944	The site is a large area that appears to have been used for dumping domestic refuse during an early period, probably pre-1944. The exact boundaries are unknown. The area is relatively flat and appears to have been mechanically leveled with scattered small debris and building detritus.	Accepted	Not Documented	N/A								
600-206	Burial Ground	100-IU-6	N/A	1943-1945	The site is a burial ground used for the disposal of scrap graphite and building rubble associated with the 101 Building. The 101 Building was plowed into the ground when it was demolished. Records appear to indicate that the site received debris from the demolished building. Remnants of the site remain on the surface. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-035	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-207	Dumping Area	100-IU-6	76.2 m x 18.29 m x 3.05 m	1943-1945	The site is a large coal ash pile, along with a second smaller ash pile to the northwest. The waste is ash that appears characteristic of powerhouse ash and probably came from coal-fired power houses used at the Hanford Construction Camp. The dirt road leading to the main site has been overlaid with ash. The waste has been placed in a discernible unit (pile). EP Toxicity tests and analytical assays of ash piles have found no evidence to indicate hazardous, dangerous, or radioactive waste exists at coal ash sites where no other waste disposal occurred.	Rejected	WSRF 97-038	N/A								
600-208	Pond	100-IU-6	18.29 m x 6.10 m x 1.52 m	Not Documented	Site 600-208 represents a series of liquid disposal ponds or trenches designed to receive wastewater and chemicals used for the boiler houses at the Hanford Townsite Construction Camp. The waste was wastewater and chemicals. The chemical released most frequently to the ponds would have been water softener brine. The locations of 13 of the 18 ponds have been identified using photographs of the camp. There are no obvious signs of contamination.	No Action	WSRF 2004-096	N/A								
600-209	Dumping Area	100-IU-2	Not Documented	Not Documented	The site is several stacks of excess railroad ties. The ground surface at the site appears to have been graveled, suggesting that the entire area was a warehouse area for industrial type materials. The waste is creosote-soaked railroad ties and possibly creosote in the soil underneath the railroad ties. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-029	N/A								
600-213	Storage Tank	100-IU-6	Not Documented	Not Documented	The site is underground fuel storage tanks that were associated with the Hanford Airport. Two field walkdowns have not found visual evidence of fuel storage tanks.	Accepted	Not Documented	N/A				Arsenic	3.2	\	2.82	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-23	Dumping Area	100-IU-6	18.29 m x 60.00 m	Not Documented	The waste site was an area of buried debris inside a large gravel pit (WIDS site code 600-248). The selected remedial action for the 600-23 site included excavating the site to the extent required to meet specified soil cleanup levels, and disposing of contaminated excavation materials at the ERDF at the 200 Areas of the Hanford Site. The CVP demonstrates that remedial action at the 600-23 site has achieved the RAOs and corresponding RAGs. The northeast portion of the pit is still actively used as a gravel source for backfill material.	Interim Closed Out	CVP-2001-00020	1-Feb-01	12/2001 (CVP date)	16330	5	Barium	78.6	\	69.1	\
												Cadmium	0.32	\	0.153	\
												Chromium Total	11.6	\	9.97	\
												Hexavalent Chromium	0.82	\	0.82(1)	\
												Lead	6	\	5.5	\
												Manganese	313	\	290	\
												Selenium	0.32	\	0.32(1)	\
												Silver	0.12	\	0.12(2)	\
												Zinc	77.7	\	60.9	\
												(1) Greater than half of the sample results for this COC were below detection; therefore, the statistical value is set equal to the maximum concentration detected.				
												(2) Indicates that COC was not detected in any of the cleanup verification samples. Value is the analytical PQL.				
600-234	Dumping Area	100-IU-2	45.7 m^2	Not Documented	The site is pre-Hanford farmstead debris. The site contains miscellaneous materials including cans, bottles, sheetmetal, and wire. The site appears to be pre-Hanford homestead debris including metal, glass, and wire from wooden irrigation pipe.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								
600-239	Dumping Area	100-IU-6	Not Documented	Not Documented	The site contains several large wooden beams, wooden pallets, large-diameter steel pipe, steel plates, large mesh steel screens, and rubber tires. All wastes observed were lying in neat piles on the ground surface within Pit 16; none appeared to be partially buried. One stacked pile of metal posts had some radiation warning signs still attached. There is a spot of old paint, about 0.3 m^2 (1 ft^2) in the pit. This gravel pit was related to the adjacent Hot Mix Plant (600-20, reclassified as Rejected). However, some of the stored materials in the pit may have come from other projects. There is no evidence of any hazardous materials at the site.	No Action	Not Documented	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-24	Dumping Area	100-IU-6	Not Documented	Not Documented	The site shows evidence of several former building foundations and walkways located along both sides of the roadway. A concrete pad exists with concrete cradles for a large water tank. A well is located in the concrete pad. The waste at this unit includes foundations, pipes (above and below grade), paint cans, a pile of army fence posts, antifreeze cans, and miscellaneous debris. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-031	N/A								
600-240	Dumping Area	100-IU-6	Not Documented	Not Documented	The site is metal and wooden debris scattered within Gravel Pit 17. The debris originated from the 615 Hot Mix Plant and operation of the gravel pit (Hanford Aggregate Pit). The waste is metal pipe, coarse mesh screens, wood, sheetmetal, concrete, a rubber tire, and a pile of asphalt pieces mixed with soil, gravel, and cobble. To the east of the pit is an irregularly shaped pile of a mix of asphalt pieces, soil, gravel, and cobble, about 12 m by 3.5 m by 1 m high (40 ft by 12 ft by 3 ft high). This pit is related to the adjacent Hot Mix Plant (600-20, reclassified as Rejected), and adjacent to Pit 16, Site 600-239.	Rejected	WSRF 2001-018	N/A								
600-250	Dumping Area	100-IU-6	Not Documented	Not Documented	The site is a recorded cultural resources site, a historic homestead where rusty sheet metal vent ducting and other miscellaneous debris have been abandoned, including broken bricks and concrete, old lumber, metal cables, and wiring. Some of the debris extends on to the top of the bank, including some half-buried, rusty cans.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the regulators.	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-251	Dumping Area	100-IU-6	Not Documented	Not Documented	The site is a near-vertical (tilted at about 20 degrees) steel pipe with the above ground portion of the pipe approximately 1.2 m (4 ft) in length. The reason the pipe is tilted is not known. The pipe appears to be buried in the ground about 6 m (20 ft). The pipe is approximately 0.46 m (1.5 ft) in diameter with a 1.3 cm (0.5 in.) thick wall. The pipe is rusted and filled with earth up to the level where it enters the ground. A well identification label is attached to its side (B8542). The pipe is covered with a flat metal lid. The pipe was reported to WIDS as a result of a RCRA General Inspection in 1997. It is listed on the Hanford Well Information System with identification number B8542, and will be decommissioned as a well in the future.	Not Accepted	TPA-MP-14 WIDS Discovery Site Evaluation checklist approved by the Regulators.	N/A								
600-257	Storage	100-IU-6	12.19 m x 3.66 m x 2.44 m	1944	The 213-K Vault is described in site code 600-108. The 213 facility (213-J and 213-K) was constructed into the south side of the base of Gable Mountain. The vaults are two parallel, reinforced-concrete, earth- covered storage facilities. The vaults (213-J and 213-K) were constructed for storage of Hanford Site plutonium and were used only briefly for that purpose. No smearable radioactivity or radiation above background was detected inside the 213-J Vault in 1981. 213-J was used by PNNL to store uncontaminated soil samples collected from around the world from a fallout study. In March 2002, PNNL removed the soil samples from the 213-J Vault, and the vault is now empty. This site refers only to the 213-J Vault.	Accepted	EPA/ROD/R10-99/039	N/A								
600-26	Dumping Area	100-IU-6	Not Documented	Not Documented	The site consists of an excavation containing a construction refuse burn pile. Wastes include construction debris, barrels, and possible asbestos. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-032	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-263	Dumping Area	100-IU-2	Not Documented	Not Documented	Seven cans are scattered within a distance of 2 m (6.6 ft) of each other. Conversations between the Hanford Fire Department and the U.S. Army Corps of Engineers determined the cans originally held calcium hydride, which was used to produce hydrogen for weather balloons. In the presence of water, calcium hydroxide produces hydrogen and calcium hydroxide; calcium hydroxide exposed to the environment becomes calcium carbonate. Samples of the powder were collected and results are consistent with hydrolysis material.	Rejected	Not Documented	N/A								
600-27	Dumping Area	100-IU-6	Not Documented	Not Documented	The site contains wells, valve pits, foundations, and a dumping area. Building debris includes concrete footings, concrete pads, transite, sewer pipe, electrical wiring, and a large diameter clay pipe with no incoming/outgoing pipes. The area surrounding the wells shows evidence of former roads and walkways that have been overgrown with weeds. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-041	N/A								
600-272	Unplanned Release	100-IU-6	103.33 m (depth)	Not Documented	The site is either a French drain or dry well that is a 61 cm (24.5 in.) concrete pipe with a steel lid. It appears to be about 1 m (3.3 ft) deep. The waste may have been steam condensate. No inlet pipe is apparent inside the structure.	Accepted	Not Documented	N/A								
600-279	Dumping Area	100-IU-2	37 m x 30 m	Not Documented	The site is a large area of white ash surrounded by dried grass. The site is apparently related to an old orchard. It is suspected that the site is the remains of a burned storage shed. The yellow material has a sulfur odor. Sulfur was used in orchards to control mold on fruit. The burned metal pieces could be pieces of farm equipment.	Accepted	Not Documented	N/A								
600-280	Dumping Area	100-IU-6	10 m x 6 m	Not Documented	The site is an area where tar was dumped.	Discovery	Not Documented	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-293	Unplanned Release	100-IU-2	24.70 m x 26.60 m	1944	The service station supported the White Bluffs Central Shops. This site may include USTs, associated piping, and the underlying soil. This facility was used to dispense fuel for automotive use. BHI-00448 states that the service station was demolished in 1975, but no documentation was found related to removing any USTs. A subsidence area was noted at the site.	Accepted	Not Documented	N/A								
600-294	Unplanned Release	100-IU-2	Not Documented	Not Documented	The site was the location of a service station with the potential for USTs, associated piping, and underlying soils. The service station contained two gasoline pumps and two buried tanks with a total capacity of 15,000 L (4,000 gal), one diesel fuel pump, and a 3,785 L (1,000-gal) buried tank. The waste includes petroleum-product-contaminated soil, USTs, and associated piping. Contaminants of potential concern may include petroleum products (TPH, PAH) and possibly ICP metals. The service station was demolished and buried in place in 1975.	Accepted	Not Documented	N/A								
600-295	Unplanned Release	100-IU-2	39.93 m x 11.89 m	Not Documented	The site consists of surface and underlying soils associated with the former Paint Shop that was used to support the White Bluffs Central Shops. Contaminants of potential concern would include VOA, semi-VOA, ICP metals with mercury in the soil. The paint shop is associated with the 600-176 dump site.	Accepted	Not Documented	N/A								
600-296	Sanitary Sewer	100-IU-2	Not Documented	Not Documented	The site consisted of the septic system for the White Bluffs Fire Department.	Accepted	Not Documented	N/A								
600-297	Sanitary Sewer	100-IU-2	Not Documented	Not Documented	The site was a septic tank. The septic tank received effluent from the White Bluffs Facilities complex.	Accepted	Not Documented	N/A								
600-298	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site consists of scattered surface debris and stained soil.	Accepted	Not Documented	N/A								
600-299	Unplanned Release	100-IU-2	Not Documented	Not Documented	The site consists of areas of scattered surface debris including batteries.	Accepted	Not Documented	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-3	Dumping Area	100-IU-6	487.68 m x 281.94 m	<1943-~1958	The site may have been used as the disposal site for the railroad yard maintenance shop (6718 Locomotive House) and consists of a shallow trench that appears to be an old borrow pit and a dumping area. Both the dumping area and pit show signs of an attempt to cover the waste, with bulldozer tracks being prevalent throughout the areas as well as evidence of burning. On March 10, 1992, a radiation survey, using standard field equipment, was performed at several different locations throughout the site. No detectable contamination was found in any of the debris. Waste includes dried paint and paint cans, drum closure rings, roofing paper, a white fibrous substance suspected of being asbestos, broken wet cell battery cases and plates, stainless steel pipe and materials, containers (three that are labeled as containing ethylene glycol), machine operations cuttings, pieces of aluminum, burnt wood, and the remains of dry cell batteries.	Accepted	EPA/ROD/R10-99/039	N/A								
600-300	Unplanned Release	100-IU-2	Not Documented	Not Documented	The site consists of miscellaneous scattered debris.	Accepted	Not Documented	N/A								
600-301	Sanitary Sewer	100-IU-2	Not Documented	Not Documented	The site consists of the sewer pipelines in the White Bluffs area.	Accepted	Not Documented	N/A								
600-302	French Drain	100-IU-2	Not Documented	Not Documented	The site consists of a French drain with a vent pipe.	Accepted	Not Documented	N/A								
600-303	Unplanned Release	100-IU-2	Not Documented	Not Documented	The site consists of four pipes of unknown origin stubbed out of the ground.	Accepted	Not Documented	N/A								
600-304	Product Piping	100-IU-2	Not Documented	Not Documented	The site consists of the White Bluffs clean water pipelines.	Not Accepted	Not Documented	N/A								
600-305	Unplanned Release	100-IU-2	Not Documented	Not Documented	The site consists of areas of scattered suspect asbestos debris.	Accepted	Not Documented	N/A								
600-306	Burn Pit	100-IU-2	Not Documented	Not Documented	The site is a burn area with miscellaneous burnt debris.	Accepted	Not Documented	N/A								
600-307	Burn Pit	100-IU-2	Not Documented	Not Documented	The site is a burn area with miscellaneous burnt debris.	Accepted	Not Documented	N/A								
600-308	Unplanned Release	100-IU-2	Not Documented	Not Documented	Garnet sand has been identified on the ground surface, and makes up this unplanned release.	Accepted	Not Documented	N/A								
600-309	Burn Pit	100-IU-2	Not Documented	Not Documented	The site is a burn area with miscellaneous burnt debris.	Accepted	Not Documented	N/A								
600-310	Burn Pit	100-IU-2	Not Documented	Not Documented	The site is a burn area with miscellaneous burnt debris.	Accepted	Not Documented	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-311	Burn Pit	100-IU-2	Not Documented	Not Documented	The site is a burn area with miscellaneous burnt debris.	Accepted	Not Documented	N/A								
600-312	Burn Pit	100-IU-2	Not Documented	Not Documented	The site is a burn area with miscellaneous burnt debris.	Accepted	Not Documented	N/A								
600-313	Burn Pit	100-IU-6	Not Documented	Not Documented	The area is described as being oil stained and a burn area.	Accepted	Not Documented	N/A								
600-314	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as components of telecommunications.	Accepted	Not Documented	N/A								
600-315	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as a black granular stain on the soil surface.	Accepted	Not Documented	N/A								
600-316	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as surface debris from dry cell batteries.	Accepted	Not Documented	N/A								
600-317	Burn Pit	100-IU-6	Not Documented	Not Documented	The site is described as scattered surface debris consisting of wet cell battery plates, burned material, and a white granular substance.	Accepted	Not Documented	N/A								
600-318	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as wet cell battery debris lying on the ground surface at multiple locations.	Accepted	Not Documented	N/A								
600-319	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as surface debris consisting of ferrous metal, stained soil, and dried plants.	Accepted	Not Documented	N/A								
600-320	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as petroleum based material released to the ground surface.	Accepted	Not Documented	N/A								
600-321	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as surface soils with suspect friable asbestos and pipe lagging.	Accepted	Not Documented	N/A								
600-322	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as an 203 mm (8-in.) diameter carbon steel pipe with a diamond plate cover.	Accepted	Not Documented	N/A								
600-323	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as a bermed area with coal cinders and an apparent ditch running east and west.	Accepted	Not Documented	N/A								
600-324	Burn Pit	100-IU-6	Not Documented	Not Documented	The site is a concrete pad with miscellaneous pipe and auto parts debris with burnt wood and metal debris.	Accepted	Not Documented	N/A								
600-325	Burn Pit	100-IU-6	Not Documented	Not Documented	The site consists of burned roofing materials.	Accepted	Not Documented	N/A								
600-326	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site consists of a material that appears to be brittle, with some angular pieces. It is black in color and has a hydrogen sulfide odor.	Accepted	Not Documented	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
600-327	Process Unit/Plant	100-IU-6	Not Documented	Not Documented	The site is a large depression filled with Russian thistle, a 2.5 cm (1-in.) water pipe stub located on the north side of the depression and the underlying soil.	Accepted	Not Documented	N/A								
600-328	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as scattered lead slag with a small stained soil area.	Accepted	Not Documented	N/A								
600-329	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is an unknown concrete structure near the Construction Shop of the Hanford townsite operations.	Accepted	Not Documented	N/A								
600-330	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is the historical location of the Hanford era gasoline service station.	Accepted	Not Documented	N/A								
600-331	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as the previous location of the lime sulfur barrel location.	Accepted	Not Documented	N/A								
600-332	Sanitary Sewer	100-IU-6	Not Documented	Not Documented	The site is the septic system that supported the small arms firing ranges at Gable Mountain.	Accepted	Not Documented	N/A								
600-333	Process Unit/Plant	100-IU-6	Not Documented	Not Documented	The site is a below grade concrete structure with three vertical shafts.	Accepted	Not Documented	N/A								
600-334	Process Unit/Plant	100-IU-6	Not Documented	Not Documented	The site is described as a rectangular raised soil area.	Accepted	Not Documented	N/A								
600-335	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is described as the service station that was identified in historical photograph # P-8244.	Accepted	Not Documented	N/A								
600-341	Dumping Area	100-IU-2	Not Documented	Not Documented	Consists of four (4) areas that contain dry cell battery remnants and/or battery debris.	Accepted	Not Documented	N/A								
600-342	Dumping Area	100-IU-2	Not Documented	Not Documented	Consists of an area that contained discarded radiological protective clothing.	Accepted	Not Documented	N/A								
600-343	Dumping Area	100-IU-2	Not Documented	Not Documented	Consists of residual ash from burned material and dumped asphalt in an excavated trench.	Accepted	Not Documented	N/A								
600-344	Unplanned Release	100-IU-2	Not Documented	Not Documented	This feature is a stained area with metal pre-Hanford container lids.	Accepted	Not Documented	N/A								
600-345	Unplanned Release	100-IU-2	Not Documented	Not Documented	This feature is a stained area with oil filters.	Accepted	Not Documented	N/A								
300-346	Unplanned Release	100-IU-2	Not Documented	Not Documented	Consists of four small fly ash dump areas with metal debris. These areas are lacking in vegetation.	Accepted	Not Documented	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-5	Dumping Area	100-IU-2	irregular	Not Documented	The site consists of a circular asphalt or heavy oil area, an asphalt or heavy oil ditch, and an area of surface debris that appeared to contain household material, such as broken ceramic dishes and kitchen-type items. The asphalt or heavy oil material that makes up the pad and ditch does not appear to contain gravel, making its appearance different from that of typical roadway type asphalt surfaces. It is unknown whether the pad and ditch were planned construction or the result of the dumping of a heavy oil type substance; however, they appear to have been planned.	Accepted	EPA/ROD/R10-99/039	N/A								
600-50	Depression/Pit (nonspecific)	100-IU-6	274.32 m x 91.44 m	1943-1945	The site is the remnants (coal dust) of the coal pile that supplied coal to the Hanford Construction Camp residents. There are man-made mounds on the northeast corner of the site. No waste materials are in evidence.	Rejected	WSRF 97-033	N/A							\	\
600-52	Drain/Tile Field	100-IU-2	85.34 m x 39.62 m	Not Documented	The site is a depression. A pile of dead trees lies near the center of the depression. Some concrete and rebar demolition debris was located on the north side of the site along the powerline road. Some wood demolition debris was also found within the depression area. Potentially, the depression was used as a surface drain field. This site was assumed to be associated with the Pickling Acid Cribs (site code 600-106). A 1948 aerial photograph showed a ditch leading from the ice house wastewater drain field to the 600-52 basin. Samples were collected at three locations in the surface basin in 1992. A field walkdown conducted in April 2003 revealed no debris or anomalies. It was determined that no additional samples would be required. The site has been evaluated and determined to meet RAOs.	No Action	WSRF 2003-28	N/A				Chromium	43.1	\	\	\
												Copper	23.5	\	\	\
												Lead	1,070	\	\	\
												These COCs represent chemicals with average concentrations above background that were subsequently used to calculate risk-based goals.				

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

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													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
600-98	Sanitary Landfill	100-IU-2	140 m x 60 m	1850-1943	This site consisted of two unlined, pre-Hanford landfills. A small amount of scattered surface debris (cans, glass, and wood) was visible at dump area 1. Dump area 2 was an area of gravel ridges and surface scars. Both areas were used for the disposal of normal industrial and domestic wastes. Following operational use, the sites were backfilled. The results of an evaluation have demonstrated that the site was a pre-Hanford Site dumping area and borrow pit, and showed that there are no hazardous/dangerous materials present at the site and, accordingly, no residual contamination in the soil.	No Action	WSRF 2004-098									
600-99	Burial Ground	100-IU-2	38.01 m x 41.00 m	1948-1955	This site contained minor construction equipment used by the J. A. Jones Construction Company, including wood scraps, concrete, and some metallic waste. However, the excavation records indicate that the site contents were removed to the 200 Area Burial Grounds in 1971 because of radioactive contamination in the landfill.	No Action	WSRF 2003-37					Arsenic	3(<BG)	\	N/A	\

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628-1	Burn Pit	100-IU-2	70.10 m x 39.62 m	Not Documented	The site has been remediated and interim closed out. It cannot be determined if the gravel was natural erosion, backfill, or both. It is suspected but not documented that the pit was used to dispose of hazardous chemicals or staged fire fighting training fires. A 1948 aerial photograph indicates that the area was used as a parking area for the demolished American Pipe Company building. Although the site was called a burn pit, no depression or pit exists. The burn site was apparently on a layer of soil on top of the demolished building's foundation. It was assumed that the burning activities occurred as the result of burning debris while the buildings were being demolished.	Interim Closed Out	WSRF 2003-46	Apr-03	N/A	Not Specified	0.37	Barium	83(<BG)	\	N/A	\
												Chromium	13.6(<BG)	\	N/A	\
												Lead	5.1(<BG)	\	N/A	\
												Barium	101	\	83	\
JA JONES 1	Dumping Area	100-IU-6	30.48 m x 15.24 m	1975-1979	The site has been remediated and closed out. The site originally consisted of a trench dug from east to west, located on the west side of a depression and used by the JA Jones Company for the disposal of miscellaneous debris, construction waste, and paint products. An interview with an employee revealed that in 1977, 7 to 10 pickup truckloads of overstocked paint and solvents were disposed in this pit. The containers were opened and the contents emptied onto the ground in the pit. The empty containers were then thrown into the pit.	Interim Closed Out	CVP-2001-00019	Jan-01	4/1/2001 (sampling)	12,700	3.4	Cadmium	0.5	\	0.5	\
												Total Chromium	26.1	\	15.5	\
												Lead	76.7	\	31.2	\
UPR-600-11	Unplanned Release	100-IU-6	Not Documented	1980	The site was an area within the JA Jones Pit 1 where contaminated material was mistakenly disposed. The contaminated material was removed in 1980 and the area released from radiological control. There is no visual evidence of this occurrence. UPR-600-11 was associated with the 305-B Berm (WIDS Site 300-29) and the JA Jones Pit 1 (WIDS Site JA Jones 1).	Closed Out	See JA Jones 1 Site	See JA Jones 1 Site				Arsenic	7.5	\	\	\

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]	Max Concentration (pCi/g, mg/kg) Deep[b]	95% UCL (pCi/g, mg/kg) Shallow[a]	95% UCL (pCi/g, mg/kg) Deep[b]
UPR-600-16	Unplanned Release	100-IU-6	54.86 m x 30.48 m	1951	In November 1951, a criticality excursion resulted in extensive plutonium contamination inside the 120 Building. On December 4, 1951, decontamination was in the final stages when a spontaneous ignition of decontamination materials caused a fire that gutted the entire building. Plutonium contamination was spread by the fire and also washed into the soil by the water used to extinguish the fire. The area was stabilized with clean soil and gravel to prevent wind from spreading the contamination further. The 120 Building was sealed and the area was enclosed within a locked fence and posted as a radiation area. In 1974, a cleanup project was initiated. The 120 Building and its crib were removed and the area was released from radiological posting. The area within the fence was cleared of the rock and sand overburden that had been placed over the contamination when the site was abandoned. Contamination was identified in the overburden, but did not extend beyond the 120 Building foundation area. Confirmatory sampling was performed in 2004.	Interim Closed Out	WSRF 2008-045	April 2004 (confirmatory sampling)	May 2004 (confirma-tory sampling)	None	1.22 (sampling depth)	Barium	138	\	\	\
												Beryllium	0.66 (<BG)	\	\	\
												Boron	0.95	\	\	\
												Cadmium	0.36 (<BG)	\	\	\
												Chromium (total)	17.9 (<BG)	\	\	\
												Cobalt	9.7 (<BG)	\	\	\
												Copper	29.1	\	\	\
												Lead	11.3	\	\	\
												Manganese	441 (<BG)	\	\	\
												Mercury	0.02 (<BG)	\	\	\
												Molybdenum	0.27	\	\	\
												Nickel	23.6	\	\	\
												Vanadium	51.3 (<BG)	\	\	\
												Zinc	60 (<BG)	\	\	\
												Zinc	60 (<BG)	\	\	\
UPR-600-18	Unplanned Release	100-IU-6	Not Documented	1987	The site is an area where petroleum products leaked to the soil from a fuel delivery truck accident. The release occurred April 16, 1987, and resulted in the spill of CERCLA-reportable materials. The release was a total of 1,354 L (395 gal) of fuel consisting of 26 L (7 gal) of #2 diesel oil, 434 L (112 gal) of unleaded gasoline, 38 L (10 gal) of ethylene glycol, and 856 L (226 gal) of leaded gasoline. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-036	N/A								

Table B-1. 100-F/IU-2/IU-6 Waste Sites Description and History

Site Code	Site Type	OU	Site Dimensions	Dates of Operation	Site History	Class Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Maximum Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)		95% UCL (pCi/g, mg/kg)	
													Shallow[a]	Deep[b]	Shallow[a]	Deep[b]
UPR-600-19	Unplanned Release	100-IU-6	Not Documented	Not Documented	The site is an unplanned release. An old wooden barrel that pre-dated MED operations deteriorated and collapsed, spilling the contents (about 45 kg [100 lb] of powdery lime sulfur) onto the ground. All the lime sulfur, the barrel, and the soil immediately underlying these materials were removed in December 1997 and placed in a storage container. The container was placed at a hazardous waste staging area for eventual offsite disposal at a permitted facility. No evidence exists that hazardous, dangerous, or radioactive waste was disposed at this site.	Rejected	WSRF 97-037	N/A		The composite sample results indicate that the material sampled is above the MTCA levels for both arsenic and lead. The sample result for arsenic was 5,654 g/kg per kilogram. The sample result for lead was 3,720 mg/kg.						

Note:

* All concentrations considered to be in the "deep zone" (below 4.6 m bgs). For this site, shallow zone will be defined as 1 ft beneath the FSB and Deep zone will be defined as 8 to 10 ft beneath FSB.

a. Shallow zone = soil above 4.6 m above ground surface

b. Deep zone = soil below 4.6 m above ground surface

/ = No data collected
4,4-DDD = dichlorodiphenyldichaloroethane
4,4-DDE = dichlorodiphenyldichloroethylene
4,4-DDT = kichlorodiphenyltrichoroethene
°C = degrees Celsius
°F = degrees Fahrenheit
BCM = bank cubic meters
BG = Background
BHI = Bechtel Hanford, Inc.
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (also known as Superfund)
COC = Contaminant of Concern
COPC = contaminant of potential concern
CVP = Cleanup Verification Package
CY = Calendar Year
D&D = Deactivation and Decommissioning
EAF = Experimental Animal Farm
EP = extraction procedure
EPA = U.S. Environmental Protection Agency
ERC = Environmental Restoration Contractor
ERDF = Environmental Restoration Disposal Facility
FSB = Fuel Storage Basin
GPR = ground-penetrating radar
ICP = inductively coupled plasma
ISS = Interim Safe Storage
MED = Manhattan Engineering District
MTCA = Model Toxics Control Act (short title of RCW 70.105d)
N/A = Not Applicable
ND = Not Detected
OHWM = ordinary high water mark
PAH = polyaromatic hydrocarbon
PCB = polychlorinated biphenyl
pH = acidity or alkalinity of an aqueous solution
PNNL = Pacific Northwest National Laboratory
PQL = practical quantitation limit
RA = remedial action
RAGs = Remedial Action Goals
RAO = remedial action objective
RARA = radiation area remedial action
RCRA = Resource Conservation and Recovery Act of 1976
RESRAD = RESidual RADioactivity (dose model) (ANL, 2007)
ROD = Record of Deicsion
RSVP = Remaining Sites Verification Package (
S&M = surveillance and maintenance
SAP = sampling and analysis plan
TC = temporary construction
TPHs = total petroleum hydrocarbon
UCL = Upper Confidence Limit
UST = underground storage tank
VOA = volatile organic analyte
VSR = vertical safety rod
WAC = Washington Administrative Code
WIDS = Waste Information Data System
WSRF = Waste Site Reclassification Form

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Appendix C

Summary of 100-F/IU-2/IU-6 Facilities

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C Introduction

The table provides a summary of the buildings/facilities that have existed in the 100-F/IU-2/IU-6 area of the Hanford Site. Many of these buildings/facilities have been demolished or are no longer used. The table also provides physical dimensions and a brief history for each building/facility.

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Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
103-F	Storage	100-FR-1	17.7 x 8.2 x 5.2	1943	1977	Demolished	The 103-F Fresh Metal Storage Building consists of one storage room and a loading platform. The facility was demolished in 1977 and the debris buried in the 182-F Reservoir.
105-F	Reactor	100-FR-1	71.3 x 55.2 x 3.7 34.1 x 22.9 x 4.6	1944	2003	Inactive	The 105-F Reactor was constructed in 1944 with sustained operations beginning in December of that year. The reactor continued operations until 1965 when it was retired. Its contaminated components included the reactor block, a storage basin for irradiated fuel, and other contaminated portions of the reactor building. It contained an estimated 85.3 metric tons [994 tons]) of lead and asbestos, and 13.6 kg (30 lb) of cadmium. Some leakage to soil had occurred from the fuel storage basin. ISS of the 105-F Reactor included removing all portions of the reactor facility outside the reactor block shield walls and constructing the SSE, which required the installation of a new roofing system, power, and lighting, a remote monitoring system, and ventilation components. The 105-F ISS Project began January 1998 and was completed in September 2003.
106-F	Storage	100-FR-1	15.2 x 5.8 x 3.7	1943	Not Documented	Demolished	The 106-F Contaminated Equipment Storage Building was a galvanized iron Quonset hut with a plywood floor. During the historical research for the 100-F-Area, the exact location of the 106-F Building was not discovered. A review of construction drawings and historical photographs did not support its existence. Although not confirmed, this building may not have been constructed.
107-F	Retention Basin	100-FR-1	142.3 x 70.1 x 5.5	1945	1965	Demolished	The 107-F (116-F-14) Concrete Retention Basin operated from 1945 until 1965. The site received cooling water effluent from the reactor for radioactive decay and thermal cooling before water was released into the river. Contamination detected around the basin indicated that the basin leaked. A significant leakage occurred at the basin in 1955 when baffles in the basin broke loose and plugged the basin outlet. The bulk of the sludge accumulated at this location, and 1,814 metric tons (2,000 tons) were estimated to remain in this basin. The site operated until 1965 and was backfilled to a depth of 1.5 m (4.9 ft). In 1978-1979, further decommissioning knocked down the upper 3 m (9.8 ft) of the basin vertical walls and the effluent pipe sections were excavated and moved to the west basin section.
108-F	Laboratory	100-FR-1	2,880 m^2	1943	1999	Demolished	The 108-F Laboratory was designed to hold and pump various chemicals for reactor water treatment and purging. The building contained many holding/mixing tanks and pumps, along with storage bins for dry materials, conveyor systems, hoppers, and power shovels. Later, it was determined that the laboratory was not needed to support the reactor operation and the 108-F Laboratory was converted to a biology laboratory. A three-story annex was added to the building to support this mission. In 1999, the building was demolished and all debris, except the highly contaminated sump, trench, drainpipe, and some piping remnant, was removed.
108-FC	Fabrication Shop	100-FR-1	6.6 x 13.7	Not Documented	Not Documented	Demolished	The 108-FC Electrical and Glass Shop included compressed air, propane, hydrogen, oxygen, hot and cold water, and sanitary drain. After serving as a glass and electrical shop, this building was later renamed as WBF-1 Boat House. It was used for storing boating equipment for the biology program, replacing a facility that had previously been located near the White Bluffs boat launch.
110-F	Storage Tank	100-FR-1	2.4 (diameter) x 6.1; 0.6 (diameter) x 24.4	1944	Not Documented	Demolished	The 110-F Gas Storage Tanks were constructed in 1944. The tanks consisted of two low-pressure storage tanks 2.4 m diameter x 6.1 m long (7.87 ft diameter x 20 ft long), 33 high-pressure storage tanks 0.6 m diameter x 24.4 m long (2 ft diameter x 80 ft long), an unloading platform, and car spot. The tanks were supported by concrete cradles. Pipe extended from the tanks to the circulation system and equipment in the 115-F Building.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
115-F	Process Unit Plant	100-FR-1	51.2 x 29.9 x 10.2	1943	1984	Demolished	The 115-F Gas Recirculation Building operated from 1943 to 1965. It was designed to remove moisture and gases from the reactor; transfer heat from the graphite to the process tubes; control reactivity; detect water leaks within the reactor; and minimize oxidation of the graphite moderator. The facility contained drier rooms, gas piping tunnels, and filter rooms associated with the reactor inert gas processing and recirculation system. The 115-F Gas Recirculation Facility decommissioning activities began in July 1984 and were completed in October 1984.
116-F	Stack	100-FR-1	5.1 x 61	1943	1983	Demolished	The 116-F Reactor Stack was 61 m (200 ft) high with a base diameter of 5.1 m (16.7 ft). The stack sat on a double octagonal-shaped base that extended almost 5.5 m (18 ft) below grade with a 15 cm (6 in.) drainpipe in the bottom of the stack. This unit was demolished in September 1983 and buried in a trench between the 117-F Building site and the 115-F Building site. The trench was backfilled and covered with a 1 m (3 ft) layer of soil.
117-F	Process Unit Plant	100-FR-1	18 x 11.9 x 10.7	1960	1983	Demolished	The 117-F Exhaust Air Filter Building, constructed in 1960, was designed to filter ventilation air from the confinement zone of the reactor before being discharged into the atmosphere through the 105-F (116-F) Reactor Stack. Two identical filter cells were housed in the facility separated by a two-story operating gallery. Each filter cell contained two filter banks in a series. Filters and fixtures were removed and buried in the 200 West Area. The structure was decontaminated, demolished, and buried in place in 1983.
119-F	Laboratory	100-FR-1	Not Documented	1960	1965-1972	Demolished	The 119-F Sample Building was built in 1960 and was located over the ventilation ducts that connected from the 105-F Reactor to the 117-F Filter Building. The purpose of the 119-F Sample Building was to monitor the air quality of the exhaust that was released through the 116-F Stack. The 119-F Building also housed equipment that measured the radiation levels, pressure differential, and airflow in the 117-F Filter Building.
141-B	Barn	100-FR-1	150.5 m^3	Not Documented	Not Documented	Demolished	The 141-B Barn was used to contain animal feed. The facility contained a hammer mill, grinder, mixer, and scale for the preparation of feed. No piping was located in the feed barn.
141-C	Laboratory	100-FR-1	35.4 x 6.1 x 2.4	Not Documented	1979	Demolished	The 141-C Laboratory was a Butler-type building of all-steel construction and set on a concrete pad. The animal stalls were of steel, and equipped with feeding and watering facilities. A common drainage trench served all the stalls. Also included in the layout was an 18.6 m^2 (10.76 ft^2) biology laboratory, plus two small shed-type appendages used for storage of animal feed and other supplies. The facility addition constructed in 1959 was used to provide additional housing for large animals exposed to long half-life radioisotopes over extended periods. In 1979, contaminated equipment, insulation, pens, and water system were removed, packaged, and buried.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
141-F	Barn	100-FR-1	21.3 x 21.3 x 0.9	Not Documented	1977	Demolished	The 141-F Barn was part of the EAF at the 100-F Area and was used to provide long-term housing for large animals during radiobiological experiments. The facility contained animal pens with concrete floors and special sewer systems for contaminated animal wastes. Contaminated manure and sawdust from the facilities were placed in plastic-lined cardboard radiation boxes and disposed in a trench behind the 105 F Reactor Building. Contaminated manure and sawdust that could not be shoveled out of the animal pens were washed into the sewer, which went to the 141-N Sump. When the sump became full, the wastewater was pumped through a screen to the Columbia River via the process sewer system (100-F-29). The solids trapped by the screen were dried and sent to the 118-F-5 Sawdust Pit. In 1963, the 116-F-9 Animal Leach Trench was constructed 46 m (150 ft) from the northeast corner of the 116-F-14 Retention Basin, and the liquid portion of the contaminated pen wastewater from the 141-N Sump was diverted there. The facility was abandoned when PNNL moved its biological studies to the 300 Area. The building was decontaminated, and the hoods and all exhaust ducts were filled with foam and then cut in sections, packaged, and buried in the 200 West Area Burial Grounds. All contaminated tile, as well as sections of roof, sidewalls, and the concrete floor were removed, packaged, and disposed in the 200 West Area Burial Grounds. The sheep barn was demolished in 1977.
141-G	Barn	100-FR-1	133.8 m^2	Not Documented	1977	Demolished	This site is also known as the 141-G Pig Gestation Barn. The building was decontaminated, demolished, and buried in the 182-F Reservoir in 1977.
141-H	Barn	100-FR-1	214.1 m^2	1949	1977	Demolished	The barn was built in 1949. It was constructed of concrete block, and contained four rooms and a connecting hallway. It was designed to house animals with outside fenced pens adjacent to each room. The facility was later modified to 118.9 m^2 (1,280 ft^2) and contained six laboratories. The 1973 facilities inventory document reads the area was 214.1 m^2 (2,304 ft^2). In a 1965 photograph, 141-H appears roughly twice the size of 141-M, which the 1964 catalog states is 118.9 m^2 (1,280 ft^2). The modification was necessary to address the exposure of pigs to radioactive isotopes. The modified facility contained individual pens, housing areas, special waste drains for collecting and boxing contaminated waste, and a sewer line that connected building drains to the retention pit. Laboratory facilities, an isolation barn, and large animal post-mortem examination room were housed at the site. The facility also contained a muffle furnace where the bones of animals were incinerated and analyzed for radiation. The building was decontaminated, demolished, and buried in the 182-F Reservoir in 1977.
141-L	Storage	100-FR-2	Not Documented	Not Documented	1977	Demolished	The facility was used to store hay in support of the Biology Pasture. This pasture was used for pregnant ewes and lambs too young for experimental work. No work was done in the hay barn or pasture with radionuclides. The building was demolished and buried in the 182-F Reservoir in 1977.
141-M	Office	100-FR-1	118.9 m^2	Not Documented	Not Documented	Demolished	The 118.9 m^2 (1,280 ft^2) 141-M Building contained offices, lunchroom, and a change room. It was supported by the 1607-F7 septic and tile field. A 0.101 m (.33 ft) diameter vitrified clay pipe exited the west side and connected to a septic tank near the northwest corner of the building. In 1971, the main sewer line from 141-M to 141-C became plugged and spread about 64,400 L (17,000 gal) of wash water used to clean animal pens. The unplanned release was identified as UPR-100-F-1.
141-N	Septic Tank	100-FR-1	38.1 m^2	Not Documented	1977	Demolished	The 141-N Animal Sewage Handling Facility was constructed of concrete block. Contaminated animal urine, feces, and sawdust that could not be shoveled out of the experimental facilities were flushed into a special sewage system that led to 141-N. Contaminated liquids were then separated and sent to the river effluent disposal system, and after 1963, to the Animal Leach Trench. The contaminated solids were dried, temporarily stored in outdoor retention pits, and then disposed in the sawdust pit. The building had a conveyor system for transferring solid material to the retention pits. The building was decontaminated, demolished, and buried in the 182-F Reservoir in 1977.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
141-P	Barn	100-FR-1	37.2 m^2	Not Documented	Not Documented	Demolished	The 141-P Building was used to house sheep and pigs. The building had a dirt floor. The facility was removed prior to the implementation of the Tri-Party Agreement.
141-S	Barn	100-FR-2	37.2 m^2	Not Documented	Not Documented	Demolished	The 141-S Building had a dirt floor and housed sheep and pigs. An area schematic from 1970 suggests this building might have been located adjacent to the Biology Pasture in the southwest corner of F-Area.
141-T	Office	100-FR-1	Not Documented	1965	1973	Demolished	The 141-T Building appears to be a singlewide trailer, and is assumed a temporary office expansion. By 1973, it no longer appears in photographs.
142-F	Storage	100-FR-1	104.1 m^2	1952	1975	Removed	The 142- F Building was recorded after the 1952 completion of the 146-FR Radioecology and Aquatic Biology Laboratory. It was a storage building for the laboratory, replacing the 146-F Fish Laboratory Quonset hut, which housed the original 1945 fish experimentation facility. A 1973 inventory document calls this building the Ecosystems Storage, and cites 104.1 m^2 (1,120.5 ft^2) of floor space. In 1975, this facility was moved to the 300 Area and renamed 331-F.
143-F	Pump Station	100-FR-2	Not Documented	Not Documented	Not Documented	Demolished	The 143-F Facility's function is not well documented. Because of its location, it is assumed to have provided water for the Biology Pasture and perhaps the Strontium Garden. In photographs, a small metal shed, believed to be 143-F, is shown directly adjacent to and midway along the western edge of the Biology Pasture.
144-F	Barn	100-FR-1	301.9 m^2	Not Documented	1979	Demolished	The 144-F Building is originally known as 141-FS. It was an L-shaped addition made to the south end of the 141-F Sheep Barn. It contained an office, several laboratories, and a series of indoor/outdoor kennels. It was used for Pu-239 and Ra-226 inhalation studies first with mice, and then with dogs. Several hundred beagles were housed in the attached kennels, as well as the 144-R and 144-FB kennels. In December 1960, new X-ray equipment was installed in the building. A 1973 inventory document calls this Inhalation Toxicology Laboratory Kennel D, and cites its floor space as 301.9 m^2 (3,250 ft^2). However, the WIDS write-up on the 141-F Sheep Barn suggests the total floor space of both the sheep barn and the inhalation laboratories is 301.9 m^2 (3,250 ft^2). In 1978, the facility was found to be contaminated with Ra-226 and Pu-239/240. Everything, including the concrete floor, was decontaminated, removed, packaged, and disposed in the 200 West burial ground. The remainder of the office/laboratories portion was demolished in FY 1979, and the debris placed in the 183-F Clearwells. The dog kennel portion was demolished in 1977 and buried in the 182-F Reservoir.
144-FB	Laboratory	100-FR-1	26.8 m^2	Not Documented	1977	Demolished	A 1973 inventory document calls this Inhalation Toxicology Laboratory Kennel E.
144-R	Laboratory	100-FR-1	130.1 m^2	Not Documented	1977	Demolished	The 144-R Facility was a 130.1 m^2 (1,400 ft^2), single-story corrugated transite shed on a reinforced-concrete slab. In a 1973 inventory document, the facility was called Inhalation Toxicology Laboratory Kennel C. The building was decontaminated, demolished, and buried in the 182-F Reservoir in 1977.
145-F	Laboratory	100-FR-1	5.5 ft x 7.3 ft	1961	1977	Demolished	The 145-F Facility began operation in 1961. It was constructed partially underground, with an earthen berm around the walls. Pre-war steel used inside (because it was not tainted by fallout), and 0.3 cm (0.11-in.) lead sheets lined the walls and floor. Large animals were placed on a platform that was motor-driven past a NaI detector system. This allowed for the direct measurement of isotopes in large samples, not possible in the late 1950s due to the high and fluctuating background. The building was cleaned and buried in place in 1977.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
146-F	Laboratory	100-FR-1	4.9 x 24.4 x 0	1945	1951	Demolished	The 146-F Fish Laboratory was built in 1945 and had experimental troughs containing fish eggs, young fish, and other small river creatures of interest. By summer 1952, the laboratory had been replaced by a new, much larger facility (the 146-FR Radioecology and Aquatic Biology Laboratory), located just south of the 146-F Fish Laboratory. Immediately to the east of the building were six matched pairs of small rearing ponds and a trough, as well as a large circular pond. Testing began in 1945 and was conducted using various mixtures of river and effluent water to determine effects on fish. From 1947 through 1950, salmon eggs, rainbow trout, carp, and crayfish were tested under several conditions. The testing was designed to determine the accumulation of activity in bone, liver, skin, and the gastrointestinal tract. Some of the feed supplied to the fish was algae and snails. Some of the feed was grown in effluent from the 107-F Retention Basin. Construction drawing H-1-3850 indicates the ponds were backfilled June 24, 1975. Contaminated structures and equipment were removed and buried in the 200 West Area Burial Ground.
146-FR	Laboratory	100-FR-1	Not Documented	1952	1973	Demolished	Completed in 1952, the146-FR Facility replaced the 146-F Fish Laboratory. It was a single-story, rectangular concrete block building, containing troughs and laboratories. The building is missing in a December 1973 photograph. The slab for the building was removed in June 1975.
147-F	Pump Station	100-FR-1	3 x 2.4 x 2.1	Not Documented	Not Documented	Demolished	The 147-F Building contained two water pumps. A construction drawing suggests the building was partially below grade with piping in the center of the floor. The 147-F Effluent Pump House, also referred to as the Experimental Fish Hatchery Pump House, pumped effluent water used in the aquatic biology laboratories to the Columbia River via the PNNL outfall.
148-F	Pump Station	100-FR-1	3.7 x 2.7 x 2.7	Not Documented	Not Documented	Demolished	The 148-F Building housed water pumps and controlled the flow of effluent water from the 107-F Retention Basin to the 146-F Fish Ponds. In 1952, a leak in the effluent line leading to the pump house was detected. The leak was repaired, and contaminated soil was removed and covered with clean soil. In 1952, surface dirt was skimmed to remove contaminated soil near the 148 Building. In April 1952, the French drain from the 148 Pump House was cleaned out. In May 1952, an area immediately to the rear of the 148 Building was excavated to expose and repair a leak in the effluent line.
149-F	Storage	100-FR-1	Not Documented	Not Documented	Not Documented	Demolished	The 149-F Facility had a wooden frame, exterior drop siding, Masonite walls and ceiling, felt and tar roof, and a wooden floor. Although the purpose of this building is unknown, the lack of utilities connected to it and its presumed similarity to 149-FR suggest that it may have been used for storage, likely for materials associated with the 108-F Biology Laboratory.
149-FR	Storage	100-FR-1	65.0 m^2	Not Documented	Not Documented	Demolished	The facility was used for material storage. It was adjacent to the 146-FR Fish Laboratory, at the south end of the hatchery trough and rearing ponds. This building has the same number as 149-F, which is thought to have been located near 108-F.
151-F	Electrical Substation	100-FR-1	92 x 137	1944	Not Documented	Demolished	The 151-F Electrical Distribution Switch House was a single-story building on concrete blocks located along the eastern fence line of the 151-F Primary Substation. A 3.3 m wide by 3.3 m high by 22 m long (10.82 ft wide by 10.82 ft high by 72 ft long) reinforced-concrete cable pit ran beneath the block house. The 151-F Substation was fully energized in January 1945. The substation consisted of a fenced gravel-bed yard measuring 92 m by 137 m (302 ft by 449 ft). A railroad spur entered the yard from the south, and paralleled the east fence line.
152-F	Electrical Substation	100-FR-1	Not Documented	Not Documented	Not Documented	Demolished	There were 11 secondary substations located in the F-Reactor Area. Each secondary substation was constructed as an open wooden pole structure surrounded by picket fences.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
153-F	Electrical Substation	100-FR-1	Not Documented	Not Documented	Not Documented	Demolished	Six distribution substations were located in the F-Reactor Area. Each distribution substation was constructed as an open wooden pole structure surrounded by picket fences.
1605-F	Control Structure	100-FR-1	Not Documented	1944	Not Documented	Demolished	Nine guard towers located in the F-Reactor Area, numbered 1605-F1 through 1605-F9. Each guard tower was located near the perimeter road. Guard towers 1605-F2 and F3 were located on the east side of the reactor area. Guard towers F4, F5, and F6 were located on the riverside. Guard towers F7 and F8 were located along the west side. Guard towers F9 and F1 were located along the south side of the reactor area.
1608-F	Pump Station	100-FR-1	15.2 x 15.2 x 10.4	1945	1987	Demolished	The 1608-F Waste Water Pumping House—Lift Station was operated from 1945 to 1965. The facility was designed to pump effluents collected from various drains to the 107-F Retention Basin. It contained a valve room, four distribution sumps, and three sump pumps. The facility was demolished and buried in place, with work completed in 1987.
1614-F	Monitoring Station	100-FR-1	3.7 m^2	Not Documented	Not Documented	Demolished	There were three of these monitoring stations, numbered 1614-F1 through 1614-F3. Each was a small facility containing 3.7 m^2 (39.8 ft^2). Their function was to house the environmental monitoring equipment that sampled airborne process wastes.
1615-F	Process Unit/Plant	100-FR-2	7.3 x 11.0 x 4.9	1960	Not Documented	Demolished	The 1615-F facility was a small Butler building constructed in the early 1960s as part of the CGI-791 Reactor Confinement project. The building was built to serve as a windbreak for workers as they separated contaminated 117 building filters from the frames that held them in place. The facility itself has been removed, although the sloped concrete pad remains in place. The drywell associated with the building (waste site 100-F-14) also remains in place and was reclassified as a No Action site in 2005.
1621-F	Electrical Substation	100-FR-1	1.5 x 2.9 x 3.4	Not Documented	Not Documented	Demolished	Three emergency generators (1621-FA, 1621-FB, and 1621-FC) were located in the 100-F Area. Each one contained a gasoline-powered electrical generator designed to activate automatically in the case of a power failure. Fuel was stored outside of the building and placed on tall concrete saddles for gravity feeding. 1621-FA was located by the 1719-F First Aid Facility. 1621-FB was located by the 1720-F Patrol Headquarters. 1621-FC was located by the 105-F Reactor.
1701-F	Office	100-FR-2	6.1 x 9.8	1944	Not Documented	Demolished	The 1701-F Gate House/Animal Care Facility was designed as the area badge house and security patrol station. After reactor operations ceased in 1965, the Biology Program took over some of the buildings previously associated with the reactor. The 1701-F Building was converted to an animal care facility.
1701-FA	Office	100-FR-1	6.1 x 9.8	1966	Not Documented	Demolished	The 1701-FA Badge House/Small Animal Annex was a single-story building, with concrete floors and flat, concrete roofing. The building housed sanitary services and lunchrooms. The gatehouse served as the badge house and security patrol station. After reactor operations ceased in 1965, the Biology Program took over some of the buildings previously associated with the reactor. The 1701-FA Building was converted to house small animals.
1702-F	Office	100-FR-1	2.8 m^2	1944	Not Documented	Demolished	The 1702-F Gate House/Badge House referred to as the guard gate shelter.
1704-F	Office	100-FR-1	Not Documented	1945	1974	Removed	The 1704-F Office Building, also referred to as the Supervisors Office and Laboratory, contained a concrete enclosed laboratory, regular laboratory, locker room, air conditioning equipment, restrooms, and 28 offices. When the building was demolished, the foundation and some debris remained.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
1705-F	Laboratory	100-FR-1	6.1 x 17.1 x 0	1945	1975	Demolished	The 1705-F Facility, later known as the Pharmacology Laboratory, along with the 146-F Fish Laboratory, was one of the original Quonset huts erected as the experimental station. In the 1950s and 60s, it had a covered garden (1705-F Experimental Garden) just to the east of the facility. Sometime before 1973, it became known as an Inhalation Toxicology Laboratory, and is believed to have been used for plutonium inhalation studies and tissue ashing. In 1975, the Quonset hut, greenhouse, and covered garden were decommissioned and removed.
1707-F	Office	100-FR-1	184 m^2	1945	1977	Demolished	The 1707-F Patrol Headquarters (later known as the Dog Inhalation Laboratory) was located south of the 1717-F combined shops and along the main gatehouse road. The site began operation in 1945 as a facility for employees to change from street clothes to coveralls. It was later used as patrol headquarters and a maintenance change house. The facility contained rooms for lockers, lunch, wash, shower, hot water heater, toilet, and vestibules. After reactor operations ceased in 1965, the 1707-F Building was converted to Dog Inhalation Laboratory.
1707-FA	Laboratory	100-FR-1	Not Documented	1945	Not Documented	Demolished	The 1707-FA Building was constructed in 1945, and after reactor operations ceased in 1965, it was converted to a rodent inhalation laboratory. Small animals were housed at the facility.
1709-F	Office	100-FR-2	Not Documented	1944	Not Documented	Demolished	The 1709-F Fire Headquarters housed fire protection equipment and personnel. It contained garage space for three fire trucks, a hose room and hose tower, a fire extinguisher filling room, dormitory, office, restroom, and kitchen. By 1964, this building was being used for office space. When the building was demolished, the foundation and some debris remained.
1713-F	Office	100-FR-1	Not Documented	1945	1977	Demolished	The 1713-F Building, constructed in 1945, contained a storage area, office, supply room, and two toilets. After reactor operations ceased in 1965, the Biology Program took over some of the buildings previously associated with the reactor. The 1713-F Building was converted to a pathology laboratory.
1713-FA	Storage	100-FR-1	24.4 x 33.5 x 3.7	1944	1956-1958	Demolished	The 1713-FA Essential Materials Storage building was converted from the Temporary Construction Receiving and Warehouse Building. It had a wooden frame with a post-and-girder construction.
1713-FB	Storage	100-FR-1	12.2 x 30.5 x 3.4	1944	1945-1949	Demolished	Information is very limited for this 1713-FB Building. Photographic research indicates that it was originally the DuPont Engineer office during construction, then became a storage facility, then disappeared sometime before 1949.
1714-F	Storage	100-FR-1	Not Documented	Not Documented	Not Documented	Unknown	The 1714-F Storage Building (formerly numbered the second of the 1713 storage facilities) stored miscellaneous materials including janitorial supplies and small chemical stores used for non-process activities.
1715-F	Storage	100-FR-1	Not Documented	1945	1959-1962	Demolished	The 1715-F Building was constructed in 1945. The single-story facility contained two rooms, one for paint and the other for oil storage. Oils, paints, and solvents used for maintenance were stored in the building.
1716-F	Maintenance Shop	100-FR-1	160.5 m^2	1945	1977	Demolished	The 1716-F Automotive Repair Building, also referred to as the Garage Facilities and Office, and 100-F Area Garage were constructed in 1945 and housed vehicle service, repair bays, and an office . The facility was a single-story, framed structure that was connected to a contaminated drain line. The garage and service station served the F-Area for many years. It was potentially contaminated. The building was demolished in 1977 and the debris buried in the 182-F Basin.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
1716-FA	Maintenance Shop	100-FR-1	15 x 27 8 x 11	1944	1945-1949	Demolished	The 1716-FA Garage and Fuel Tanks were originally a TC-32 facility built in 1944. It consisted of four components including a main automotive repair garage, a tire repair center, a small storage building, and a set of gas pumps. The tire repair building was located on the east side of the main garage. A small lean-to building was used for storage. A gas pump station was located to the north of the automotive repair facilities. It consisted of two underground gasoline storage tanks and two pumps on a concrete platform.
1717-F	Maintenance Shop	100-FR-1	164 m^2	1945	1988	Demolished	The 1717-F combined shops, also referred to as the Maintenance Shops and Offices, consisted of a machine shop, carpenter shop, pipe shop, sheet metal shop, electric shop, forge shop, tool room, six offices, and a restroom. Oils, paints, and solvents were stored in the facility. The 1717-F was modified later to serve as a steam plant. Two boilers were installed in the northwest corner of the facility in 1964. The facility was demolished and the debris buried in the 183-F Clearwells in 1988. The WIDS has assigned waste site 100-F-32 to this facility for the underground fuel tanks that were associated with the facility.
1717-FA	Valve Pit	100-FR-1	2.4 x 3.5 x 1.3 – Pump Pit 2.5 x 2.6 – Shack	1965	Not Document	Unknown	The 1717-FA Pump Pit was an underground concrete structure used to transport fuel oil from the three underground fuel oil tanks (waste site 100-F-32) to the boilers in the 1717-F building. The system was installed in 1965 as part of the shutdown of the 105-F Reactor. The boilers in 1717-F were used to provide steam service for the 100 F Area after the decommissioning of the 184-F Power House. The pump pit was used to circulate fuel oil from the tanks to the 1717-F Building through a FOS line and a FOR line. The aboveground shack may have contained instrumentation to monitor and control the flow of the fuel oil, as well as provided cover to prevent the accumulation of rain water in the pump pit.
1719-F	Office	100-FR-1	Not Documented	1944	1977	Demolished	The 1719-F Building began operation in 1945 and contained a first aid room with emergency treatment supplies, a cot room, office, laboratory, supply closet, and two restrooms. The 1719-F Building was later converted to an animal care facility.
1720-F	Office	100-FR-1	Not Documented	Not Documented	Not Documented	Demolished	The 1720-F facility was used as the patrol headquarters. When the building was demolished, the foundation and some debris remained.
1722-F	Maintenance Shop	100-FR-1	Not Documented	1945	1959-1962	Demolished	The 1722-F Area Shop contained a riggers loft and paint storage room. The facility provided auxiliary capability for small repair jobs on 100 Area equipment and parts.
1722-FA	Electrical Shop	100-FR-1	Not Documented	1944	1945-1949	Demolished	No information is available for this electrical shop.
1729-F	Storage	100-FR-1	24.4 x 44.2 x 3.4	1944	1945-1949	Demolished	The 1729-F building was also known as the TC-32 Millwright Shop. It appears to have been kept on briefly as a permanent building in 1945, and was used to store machinery and other components. A rail spur was located just off the west side of the building for unloading materials.
1734-F	Storage	100-FR-1	Not Documented	1944	1959-1962	Demolished	The 1734-F was constructed in the F-Area in 1944 and used as the gas cylinder storage facility.
1784-F	Office	100-FR-1	9.3 m^2	1945-1949	1964-1969	Demolished	The 1784-F Coal Handler was a 9.3 m^2 (100-ft^2) building. The exact location of this building is unknown, but was probably near the 184-F Facility.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
181-F	Pump Station	100-FR-1	Not Documented	1945	1978	Demolished	The 181-F River Pump House operated from 1945 to 1965. The facility supplied water from the Columbia River to either the 183-F Water Treatment Facility or the 182-F holding reservoir facilities. Pumps were vertical deepwell types with submerged bowls and impellers. Two carbon steel pipes extend from the pump house to the 183-F head house. The foundation, pump wells, and concrete aprons were demolished and covered with soil in 1978. Guard towers were erected on the roof. The pump house was demolished in 1978 to ground level. The debris was buried in the sump well at the 181-F site, except for wood and asphalt that was disposed in the 182-F River Water Storage Reservoir. The asbestos was packaged and disposed in the 200 Area asbestos burial ground.
182-F	Process Unit/Plant	100-FR-1	170.7 x 94.2 x 4.6	1945	1978	Demolished	The 182-F Reservoir and Pump House operated from 1945 to 1965. The facility provided raw water for reactor cooling in case of an emergency and raw export water for the 100-200 Area inter-tie system. The 182-F Raw Water Reservoir and Pump House was filled with debris from the demolition of other buildings in the area and fill from adjacent land. The pump house at the end of the 182-F Raw Water Reservoir was demolished. The debris resulting from the demolition was buried in the cavity of the pumping station.
182-FA	Process Unit/Plant	100-FR-1	297 m^2	Not Documented	1977	Demolished	The 182-FA Pump Test Facility was a single-story, steel building with aluminum siding. It contained a concrete foundation, floor, and pump well. It was demolished in 1977 with the debris buried in the cavity of the pumping station.
183-F	Process Unit/Plant	100-FR-1	40.8 x 9.7 x 17 199 x 9.1 x 3.0 229 x 28 x 5.0	1944	1977	Demolished	The 183-F Filter Plant was designed to treat raw river water before it entered the reactor. It consisted of the following structures: head house, flocculation and sedimentation basins, filter building, clearwells, and pump house. All facilities, except the clearwells, were demolished in 1977 and covered with soil.
184-F	Process Unit/Plant	100-FR-1	90 (high)	1945	1978	Demolished	The 184-F Power House was operated from 1945 until 1965. The facility contained the main power house, ash removal system, boiler feed water system, two concrete smoke stacks, coal handling system, crusher house, two transfer houses and track hoppers, open coal pit, salt dissolving pit, brine pump house, electrical system, piping system, steam generation, and water treatment system. The building also supplied emergency electrical power to area buildings. Photographs show that the 184-F Building was demolished in 1969. When the facility was demolished, the two smoke stacks, boiler foundations, and salt pits were left in place. In 1977, the boiler stacks were toppled by explosives and buried in a trench that extended north from the base of the stack.
185-F	Process Unit/Plant	100-FR-1	Not Documented	1945	1977	Demolished	The 185-F Water Treatment Plant was constructed in 1945. The function of the facility was to remove dissolved gases and entrained air from the water filtration process. The facility was also used as a central shop and storage building for slightly contaminated equipment. A corner of the facility was used by Combustion Engineering, Incorporated, to retube the 100-N steam generators and was contaminated. The contaminated portion was later demolished in 1977 and buried in the 200 Area. The metal was salvaged with the remaining rubble buried in the reservoir.
187-F1	Storage Tank	100-FR-1	11.9 (diameter)	1945	Not Documented	Demolished	The 187-F1 was one of the two elevated process water tanks in the F-Reactor Area. The tanks were located near and on opposite sides of the 105-Reactor. The tanks were of identical design and constructed of 0.95 cm (3/8-in.-) thick steel plate.
187-F2	Storage Tank	100-FR-1	11.9 (diameter)	1945	Not Documented	Demolished	The 187-F2 was one of the two elevated process water tanks in the F-Reactor Area. The tanks were located near and on opposite sides of the 105-Reactor. The tanks were of identical design and constructed of 0.95 cm (3/8-in.-) thick steel plate.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
188-F	Coal Ash Pit	100-FR-2	102.1 x 102.1 x 2.3	1943	1965	Demolished	The 188-F was an open rectangular-shaped pit and dike-type basin. The facility was dug or constructed for the disposal of ashes from the 184-F Power House. The power house was equipped with automated removal of ash by pumping ash directly from the sluice pit in the power house to the Ash Disposal Basin by a chrome-iron alloy underground pipeline.
189-F	Process Unit/Plant	100-FR-1	Not Documented	1944	1977	Demolished	The 189-F Refrigeration Building was designed to cool process water before it was sent through the reactor. The 189-F facility contained large refrigeration tanks, Freon tank pits, ventilation rooms, and pumps. It was demolished in 1977 using explosive material and a demolition ball.
1901-F	Storage Tank	100-FR-1	36.6 (height) 7.5 (diameter)	1945	1954	Demolished	The 1901-F Soft Water Tank was an elevated cylindrical storage tank with a conical roof. Water from the 183-F Filter Plant was pumped to the 184-F Power House, where it was conditioned into soft water, stored in this high tank, and then used as feed water for the power house boilers.
1902-F	Storage Tank	100-FR-1	36.6 (height) 7.5 (diameter)	1945	1977	Removed	The 1902-F Sanitary Water Tank was an elevated cylindrical storage tank with a conical roof. The capacity of the tank was 283,900 L (75,021 gal). Water was pumped from the 183-F Filter Building to this high tank, where its primary function was backup water for the fire system in 100-F.
1904-F	Outfall	100-FR-1	8.2 x 4.3 x7.9	1945	1979	Demolished	The 1904-F Outfall was a concrete feature that received reactor effluent water from the 107-F Retention Basin and discharged into the river. The site operated from 1945 to 1965. Effluent water exited the structure by two paths. Under normal operations, water discharged through two 1.07 m (3.51-ft-) diameter pipes that extended 137.2 m (450 ft) to the center of the river. The second exit path was via a flume/spillway that exited into the river.
190-F	Pump Station	100-FR-1	Not Documented	1943	1977	Demolished	The 190-F facility operated from 1945 to 1965. It housed reactor cooling water tanks and pumps. The 190-FA Annex was constructed in 1955; it had a roof of lightweight aggregate concrete surfaced with built-up tar-gravel roofing. The annex was used to increase the pumping capacity of the 190-F Main Pump House and thus provide additional cooling water to the 105-F Reactor. In 1977, the 190-F was demolished using explosive material and a demolition ball. The foundation and some debris remained. In FY 1987, the process water tunnels were uncovered between the 105-F and 190-F facilities and filled to grade with clean soil.
PNNL Outfall	Outfall	100-FR-1	4.6 x 6.1	1945	N/A	Inactive	The outfall structure was in use from 1945 through 1965. This outfall was connected to a concrete spillway that transported effluent from the EAF and aquatic biology laboratory to the Columbia River. The spillway extended out from the shoreline and approximately 3.7 m (12 ft) into the Columbia River. During a February 2005 site visit, it was noted that the upper portions of the site had been demolished and covered with soil. The lower portion of the spillway is intact and visible.
STRONTIUMGARDEN	Laboratory	100-FR-2	24.4 x 9.1	1952	2002	Demolished	The site was a garden plot consisting of twelve 1.2 by 3 m (4 by 10 ft) plots arranged in two rows of six plots each. The area was surrounded on all sides and overhead by a wooden frame with 0.63 cm (0.25-in.) screen material attached. The site was established to study the behavior of plants grown in soil containing Cs-137 and Sr-90, under controlled conditions of soil tillage, irrigation, cropping and abandonment. Uptake of the radionuclides was measured in alfalfa, barley, radishes, beans, cheatgrass, and tansy mustard. The Strontium Garden was remediated in 2001-2002 as waste site 100-F-2. Excavation of the site involved removing the contaminated structure and underlying contaminated soil.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
101	Fabrication Shop	100-IU-6	557.4 m^2	1944	1952	Demolished	The 101 Building (Graphite Fabrication Facility) was located at the north end of the Hanford Construction Camp. The facility manufactured reactor core graphite components during the 1940s. More than 4,536 metric tons (5,000 tons) of graphite were stored in this facility in the late 1940s. From 1950-1952, it served as a shop area and mechanical development laboratory, providing space for shops, offices, drafting, and experimental mock-ups. The original 101 Building had an associated boiler house, containing steam-generating equipment, a wood-stove, soft water storage tank, and the boiler feed pump.
120	Laboratory	100-IU-6	Not Documented	1949	1974	Demolished	The 120 Building (Critical Mass Laboratory) was part of the P-11 Facility that supported the design of new chemical separation facilities. It was a galvanized steel building containing two test rooms, chemical mixing area, contamination storage area, change room with shower, lavatory, service sink, and hot water tank. A catch basin was located directly beneath each test room from which an outlet pipeline connected to a waste disposal crib. The mixing room contained a plutonium storage vault and equipment for adjusting solution concentration, sampling for analysis, and decontamination, which was performed in a filtered fume hood. Flushing water and other wastes generated in this room were to be collected in stainless steel drums and sent to the 200 Area. The building was supported by several ancillary facilities, including a waste disposal crib and electrical substation, as well as a septic system. On November 16, 1951, a critical excursion resulted in extensive plutonium contamination to the interior of the 120 Building. On December 4, 1951, a fire resulted in the spread of contamination to the outside of the building along the foundation and door thresholds. The contamination was fixed using sealants and concrete grout. The 120 Building was sealed off and abandoned. The P-11 facilities, crib, and underground piping were decontaminated and demolished in 1974. It is not evident from reading the facility cleanup plan or the final summary document that all of the concrete foundation of the 120 Building was removed.
121	Pump Station	100-IU-6	2.44 x 3.05 x 2.44	1949	1974	Demolished	The 121 Building (P-11 Pumphouse) was a small structure that served as a pumphouse for the P-11 project facilities, located approximately 4.8 km (3 mi.) south-southeast of 100 F Area and 0.5 km (0.33 mi.) west of Route 2N. A new well (699-63-25A) was drilled for this facility prior to construction, which consisted of a 20 cm (8-in.) steel pipe that extended to a depth of 31.6 m (103.8 ft) below grade. Equipment within the building included a deep well turbine pump, a large storage tank, a chlorine solution crock, and a water-operated hypo-chlorinator. The 121 Building provided both chlorinated and non-chlorinated water to support the P-11 project. The 121 Building was demolished in 1974 at the same time as the other P-11 facilities.
122	Control Structure	100-IU-6	2.44 x 3.05 x 2.44	1949	1974	Demolished	The 122 Building (P-11 Guard House) was a small structure that served as a guard house for the P-11 project facilities, located approximately 4.8 km (3 mi.) south-southeast of 100-F and 0.5 km (0.33 mi.) west of Route 2N. The 122 Building served as a guard house at the entry point to the P-11 Area. The 122 Building was demolished in 1974 at the same time as the other P-11 facilities.
123	Process Unit/Plant	100-IU-6	Not Documented	Not Documented	Not Documented	Demolished	The 123 Building (P-11 Control Building) was originally a pre-Hanford Site residence that was converted into a control center headquarters for the P-11 Project, located approximately 4.8 km (3 mi.) south-southeast of 100 F and 0.5 km (0.33 mi.) west of Route 2N. It provided facilities for both operators and patrol personnel, including a control room (overlooking the 120 Building), restrooms, office space, and a calculation and data plotting room. The septic system was located due east of the 123 Building. The P-11 Project supported proper design of new chemical separation facilities. Experiments were actually carried out in the 120 Laboratory but were controlled remotely by an operator in the 123 Building. The 123 Building also provided office space for P-11 personnel and the Hanford Site patrolmen. The 123 Building had been razed prior to the 1974 cleanup of the remaining P-11 buildings.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
145	Test Facility/Component	100-IU-6	Not Documented	1943	Not Documented	Demolished	The 145 Facility (CMX Semi-works) was located on the Columbia River near the Hanford Construction Camp. No written physical description of the 145 Facility has been found; however, aerial photography of the site is available. Construction was completed and startup occurred September 1943. The purpose of the facility was to determine a satisfactory process water treatment method to prevent corrosion/erosion of the aluminum canned slugs or the aluminum tubes. A secondary purpose was to develop technology to prevent or minimize the formation of film or scale on the slugs or tubes, and develop methods for film and scale removal in the event they did form. Chemicals used included sulfuric acid, ferric sulfate, and hydrogen peroxide. The CMX Program was completed October 30, 1944, and the staff transferred elsewhere; but the date of the demolition of the building itself is not known. After January 1945, the equipment was dismantled and declared excess.
213	Receiving Vault	100-IU-6	3.6 x 12.1 x 2.4	1944	Not Documented	Inactive	The 213-J and 213-K Plutonium Storage Vaults are identical reinforced-concrete, underground storage vaults located side by side on the south slope of Gable Mountain, 6.4 km (4 mi.) west of the Hanford townsite. They were constructed to store plutonium product from the separations processes. The vaults were used only briefly, if at all, for their original intended purpose of storing plutonium product. They were subsequently used for storage of explosives, for hardware contaminated with radioactive sodium, and more recently, by PNNL for seismic testing and soil samples storage. In 1981 and 1990, radiological surveys did not find any detectable contamination inside the 213-J Vault. An inspection of the vault in January 2001 confirmed that all materials have been removed. The loading docks have drains that may go to cribs.
506-A	Electrical Substation	100-IU-2	76.6 m^2	Not Documented	Not Documented	Demolished	The 506-A Facility (Telephone Exchange Building) was located north of White Bluffs.
615	Process Unit/Plant	100-IU-6	1893 L - Bituminous Tank 3028 L - Fuel Oil Storage Tank 7.32 x 1.52 - Horizontal Oil Storage Tank – 6 were at site 7.32 x 3.05 - Horizontal Oil Storage Tank – 2 were at site 3785 L - Water Storage Tank	1943	Not Documented	Demolished	The 615 Hot Mix Batch Plant Facility was located on the west side of the Hanford townsite, south of the railroad tracks, and just east of the former Hanford aggregate pit. It was originally erected for the preparation of bituminous road surfacing materials for temporary and permanent road construction. The plant consisted mainly of eight horizontal oil storage tanks (the two largest horizontal tanks remain); a single aggregate central mixer, a single drum dryer; and steam facilities. West of the tanks are the remains of a coal or ash pile. Southwest of the tanks is a pile of waste asphalt and other debris as well as a shallow trench that runs toward the southwest. More waste asphalt is found on the slope east of the trench, dumped in both solid and liquid form. A pit is located approximately 140 m (459.3 ft) south of the two tanks.
661	Military Compound	100-IU-6	381 x 555	1944	Not Documented	Demolished	The 616 complex (Rifle and Pistol Range) was located north of the east end of Gable Mountain. The complex was originally a temporary construction facility. After the construction period, the facility served to train the HEW patrolmen in weapons use. The site operated from the mid-1940s through the 1950s as a practice range for handguns, rifles, shotguns, machine guns, hand grenades, smoke bombs, and other small arms and incendiary devices. It consisted of four ranges, the 661 Range House Facility (conference room, equipment storage room, office, and restroom), the 661 Well House (for well 699-57-29A), the 661 Septic System, 661-A Gun Storage Hut, and the 661-B Hut. The range house and the well house have been removed from the site. Field surveillance activities conducted June 17, 1996, at the site revealed several 19 or 23 L (5 or 6 gal) drums (riddled with bullet holes), smoke grenade canisters (discharged and bullet riddled), bullet casings, suspected moving target devices, and concrete pads to the west of the site. Rubble, wire, and transite pipe are scattered about the site. Complete information on all types of ordnance used is not readily available.

Summary of 100-F/IU-2/IU-6 Facilities

Facility Code	Facility Type	Operable Unit	Site Dimensions (m)	Construction Date	Demolition Date	Facility Status	Facility Description
2605-K	Control Structure	100-IU-6	4.10 x 4.10 x 8.23	1944	Not Documented	Demolished	The 2605-K Building (213 Guard House) was located north of the 213 facilities, partway up Gable Mountain and consisted of an elevated observation room mounted on a four-post wood frame tower with a 0.9 m (3-ft) suspended walkway surrounding it. The 2605-K Building was designed as an observation post for Hanford plant security personnel to monitor for fires and unusual activities near the 213 Plutonium Storage Vaults. The position of 2605-K allowed a clear view of the entire area surrounding 213-J&K.
2743-J	Control Structure	100-IU-6	Not Documented	1944	Not Documented	Demolished	The 2743-J Building (213 Guard House) was a wood frame, two-story, flat roof, penthouse-type building located south of the 213 facilities, which were located at the base of Gable Mountain. The 2743-J Building served as the combination gatehouse and guard tower building for the 213-J and 213-K Vaults. The facility did not have restroom facilities initially, but were installed eventually, as evidenced by the concrete pad left behind with a hole to support plumbing, along with a septic tank cap in the ground nearby.
WBF-1	Storage	100-IU-6	6.1 x 14.6	Not Documented	est. 1993	Demolished	WBF-1 was a single-story building with a metal roof and a concrete floor. A large roll-up door allowed for movement of a boat in and out of the building. A concrete pad was located in front of the building. The original WBF-1 Building was located by the White Bluffs boat launch, to the north of 100-F. Sometime after 1964, this building was replaced by the 108-FC Facility in 100-F, which was renamed as WBF-1. The original WBF-1 was still standing in 1984, but was gone by 1993. The WBF-1 Facility was used to store a boat that PNNL used for river water studies. This equipment was also associated with the Hanford aquatic biology program.
WBF-2	Storage	100-IU-6	6.1 x 14.6	Not Documented	Not Documented	Demolished	The WBF-2 Storage Building was a single-story metal structure that measured 6.1 m (20 ft) by 14.6 m (47 ft), with a total area of 89 m^2 (291 ft^2). Unlike WBF-1, it did not have a large roll-up door. The WBF-2 Building was located on the right bank (Hanford side) of the Columbia River at the White Bluffs Boat Launch. The concrete slabs where the buildings were located remain in place. Although the White Bluffs Boat Launch is still active, both WBF-1 and WBF-2 have been removed. WBF-2 was used for storing equipment associated with the PNNL river water studies, such as nets and anchors.

Note:

CMX = Corrosion and Materials Experiments
EAF = Experimental Animal Farm
FOR = fuel oil return
FOS = fuel oil supply
FY = fiscal year
HEW = Hanford Engineer Works
ISS = interim safe storage
N/A = not applicable
PNNL = Pacific Northwest National Laboratory (*formerly known as Pacific Northwest Laboratory [PNL])
SSE = safe storage enclosure
WIDS = Waste Information Data System

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Appendix D

Implementation of Constituents of Potential Concern and Target Analyte List for 100-F/100-IU-2/100-IU-6

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Terms

ARARs	applicable or relevant and appropriate requirements
BHC	hexachlorocyclohexane
COPCs	contaminants of potential concern
EPA	U.S. Environmental Protection Agency
HEIS	Hanford Environmental Information System
MCLs	maximum contaminant levels
MCLG	maximum contaminant level goal
MDL	method detection limits
OU	Operable Unit
PAHs	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PRGs	preliminary remediation goals
QC	quality control
SVOC	semi-volatile organic compounds
TCE	trichloroethene
Tri-Parties	U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology
VOC	volatile organic compounds
WAC	Washington Administrative Code

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This appendix implements the process defined in the integrated 100 Area Work Plan (DOE/RL-2008-46, Rev. 0) for determining the contaminants of potential concern (COPCs) and target analyte lists (TALs) for the 100-F/100-IU-2/100-IU-6 operable units. The COPC and TALs were developed using the respective companies' quality standards and have undergone a vigorous check and review. Throughout the process, the Tri-Parties provided input. The list for the 100-F/100-IU-2/100-IU-6 operable units incorporates OU-specific input that has been provided from EPA.

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D1 Identification of Contaminants of Potential Concern for Groundwater Portion of the 100-IU-2/100-IU-6 Remedial Investigation/Feasibility Study Work Plan

Environmental Calculation Cover Page

Calculation No.: ECF-100FR3-10-0328 Revision No.: 0

Project: Soil and Groundwater Remediation Date: 3/17/10

Calculation Title & Description: Identification of Contaminants of Potential Concern (COPC) for the 100-IU-2/IU-6 Portion of the 100FR-3 Groundwater Operable Unit Remedial Investigation/Feasibility Study Work Plan

This calculation brief describes the selection of contaminants of potential concern for defining baseline nature and extent groundwater conditions at the 100-IU-2&6 Operable Unit.

Revision History:

Revision No.	Description	Date	Affected Pages
0	Groundwater COPC selection process prepared to support DOE/RL-2008-46-ADD4 Rev.0	3-17-2010	All

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D1.1 Purpose

This memorandum describes the method for selecting groundwater contaminants of potential concern (COPCs) in support of developing 100-F remedial investigation/feasibility study work plan documents. This memorandum specifically addresses the COPCs associated with the 100-IU-2/IU-2 portion of the 100-F operable unit (OU). A secondary objective of this memorandum is to identify the appropriate analytical methods for the COPCs. The recommended analytical methods for radiological and nonradiological COPCs are based on their ability to achieve their respective action level.

The list of COPCs identified with this method will be used for planning future risk assessment activities for the 100-IU-2/IU-6. These COPCs also will be used in the nature and extent characterization for the 100-IU-2/IU-6. The identified COPCs can be used to develop a more focused list of analytes for sampling and analysis plans, such as remedial process optimization.

The source of analytical data and selection criteria for identifying COPCs are described in Section 2, Methodology. A COPC is an analyte suspected of being associated with site-related activities that represents a potential threat to human health or the environment, and analyte data are of sufficient quality for use in a quantitative baseline risk assessment. COPCs will be carried into the sampling and analysis plan for characterization or developing baseline conditions through sampling and analysis by approved analytical methods.

D1.2 Methodology

The evaluation methodology involves a sequence of steps, consisting of 1) extracting and processing an OU-specific analytical data set, 2) screening the data for the entire groundwater OU to select analytes that qualify as initial COPCs for inclusion in the sampling and analysis plan.

D1.2.1 Analytical Data Processing

The data set obtained from Hanford Environmental Information System (HEIS) includes the following types of information:

- Filtered and unfiltered analytical results
- Data qualification and data validation flags, including rejected results
- Results reported by more than one analytical method
- Parent, field duplicate, and field split samples

As a result of these database qualities, the analytical data obtained from the HEIS database are processed to identify one set of results per sampling location and time of collection. The following describes the data processing steps taken prior to the selection of groundwater COPCs. Figure D1-1 presents the analytical data processing requirements associated with the groundwater COPC selection process and the number of records associated with each of the processing steps.

Unfiltered Sample Results. Only unfiltered nonradiological and radiological results are used for selecting COPCs. Use of unfiltered sampling results represents total concentrations of the analyte. Use of filtered sampling results may underestimate chemical and radiological concentrations in water from an unfiltered tap and are not used for the COPC selection process.

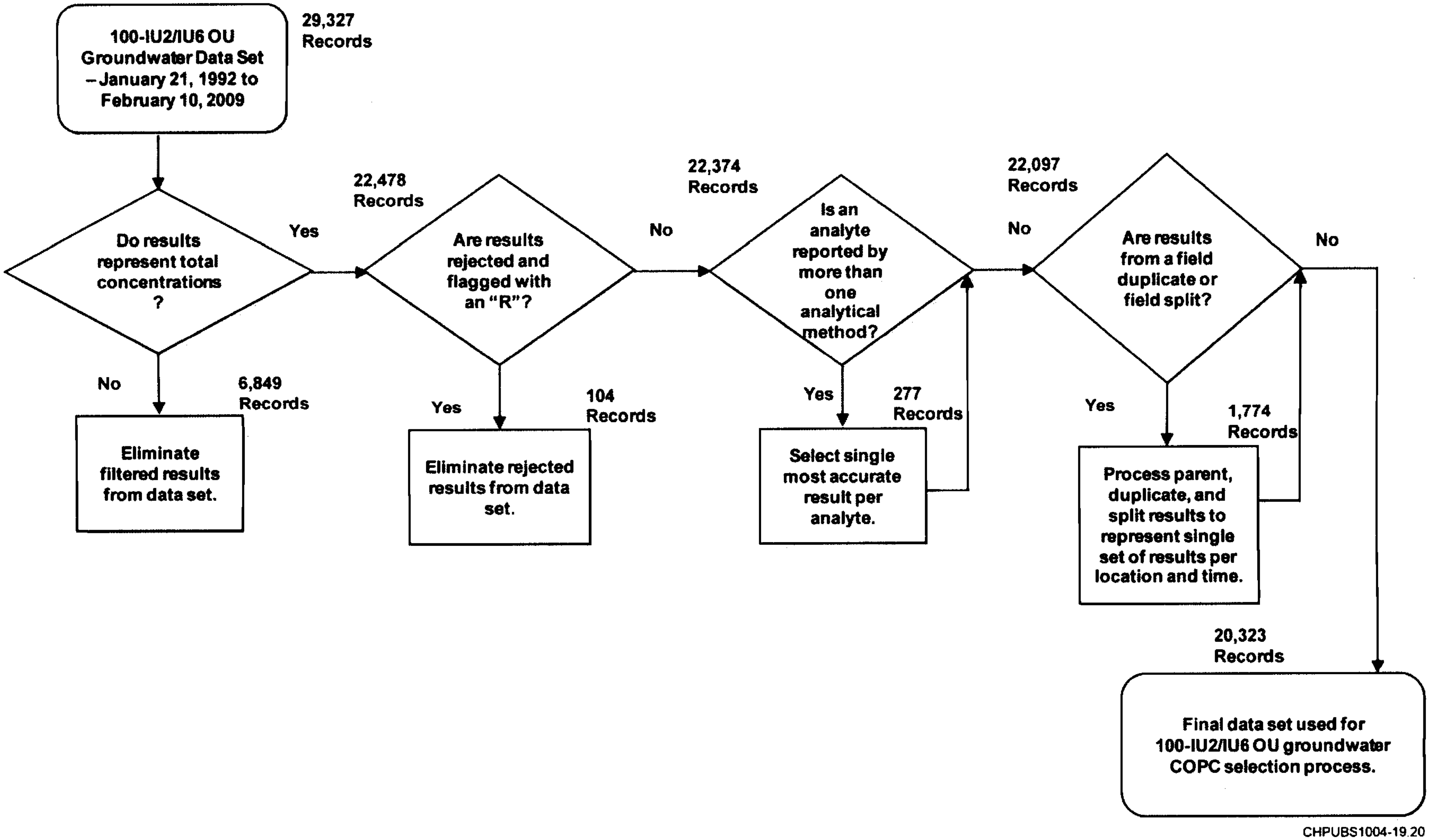


Figure D1-1. Analytical Data Processing for COPC Selection Process

Field Duplicate and Split Results. Field quality control (QC) samples (field duplicates and field splits) are collected in the field and analyzed by the laboratory as unique samples. The parent sample and QC samples are collected from the same location (i.e., monitoring well), resulting in more than one sample per location. The following criteria were used to reduce multiple sample results from one location to a single result.

- If there are two or more detections, the maximum concentration will be used.
- If there is one detection and one nondetection, the detected concentration will be used.
- If there are two or more nondetections, the lowest detection limit will be used.

Laboratory and Data Validation Flags. After receiving analytical data from the laboratory with data qualification flags, validation qualifiers are assigned during the data validation process. The following rules are applied to determine how the sample results can be used for selecting COPCs.

- All sample results flagged with a "U" qualifier or combination of qualifiers that include a "U" such as a "UJ" are considered a nondetected concentration.
- All sample results without a "U" qualifier are considered detected concentrations, including results without a qualifier or with a "J" qualifier.
- All sample data rejected and flagged with an "R" are not used for selecting COPCs.

Analytes Reported by Numerous Analytical Methods. An analyte can often be reported by more than one analytical method resulting in multiple results for the same analyte from the same location. When analytes are reported by more than one analytical method, results will be processed to select the method that provides the most reliable results. For example, the gamma spectroscopy method will provide concentration results for the uranium isotopes; however, uranium concentrations should be reported by a uranium isotope specific method.

D1.2.2 Identify Action Levels

Action levels are derived from readily available sources of chemical-specific applicable or relevant and appropriate requirements (ARARs) or risk-based preliminary remediation goals developed using U.S. Environmental Protection Agency (EPA) health criteria and default exposure assumptions. Table D1-1 identifies all sources of chemical-specific ARARs and preliminary remediation goals (PRGs) for each of the 290 analytes reported. The action level represents the lowest of the available values for each analyte evaluated. A description of the sources of available chemical-specific ARARs and PRGs follow. A description of how the action levels are used in the COPC selection process is provided in Section 5.

D1.2.2.1 ARAR-Based Remediation Goals

Potential chemical-specific ARARs include concentration limits set by federal environmental regulations such as maximum contaminant levels (MCLs), secondary MCLs, and non-zero maximum contaminant level goals established under the *Safe Drinking Water Act of 1974*, ambient water quality criteria established under the *Clean Water Act of 1977*, and Washington State regulations (WAC 173-340-720, "Model Toxics Control Act--Cleanup," "Ground Water Cleanup Standards;" WAC 173-340-730, "Surface Water Cleanup Standards;" and WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington").

Uranium isotopes are not identified as COPCs because the MCL for uranium (metal) is considered protective of kidney toxicity and carcinogenicity. The following excerpt is taken from the "National Primary Drinking Water Regulations" (Title 40 *Code of Federal Regulations* Part 141) to describe the basis for the uranium MCL:

"Exposure to uranium in drinking water may cause toxic effects to the kidney. In 1991, EPA proposed an MCL of 20 μg/L, which was determined to be as close as feasible to the maximum contaminant level goal (MCLG). Based on human kidney toxicity data collected since that time and on its estimate of the cost and benefits of regulating uranium in drinking water, EPA determined that the benefits of a uranium MCL of 20 μg/L did not justify the costs. Instead, EPA determined that 30 μg/L is the appropriate MCL, because it maximizes the net benefits (benefits minus costs) while being protective of kidney toxicity and carcinogenicity with an adequate margin of safety."

D1.2.2.2 Risk-Based Preliminary Remediation Goals

The risk-based concentration table for residential tap waters is used as the source of PRGs. These values are obtained from the "Regional Screening Levels for Chemicals Contaminants at Superfund Sites" website (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm). PRGs for chemicals with carcinogenic effects corresponds to a 10^{-6} incremental risk of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen from all significant exposure pathways for a given medium. The PRGs for chemicals with noncancerous effects corresponds to a hazard index of one, which is the level of exposure to a chemical from all significant exposure pathways in a given medium below which it is unlikely for even sensitive populations to experience adverse health effects. The direct contact exposure pathway for groundwater considers exposure from ingestion, inhalation of vapors, and dermal contact. The residential tap waters value is used only when a chemical-specific ARAR is not available.

D1.2.3 Identify Groundwater COPCs

The following process is used to identify COPCs in the 100-IU-2/IU-6 groundwater OU in support of developing 100-F remedial investigation/feasibility study work plan documents. The steps used in the COPC selection process are as described below. A flow-chart presenting the COPC selection process and the number of records associated with each of the COPC selection process steps is provided in Figure D1-2.

D1.2.3.1 Apply Exclusion Criteria

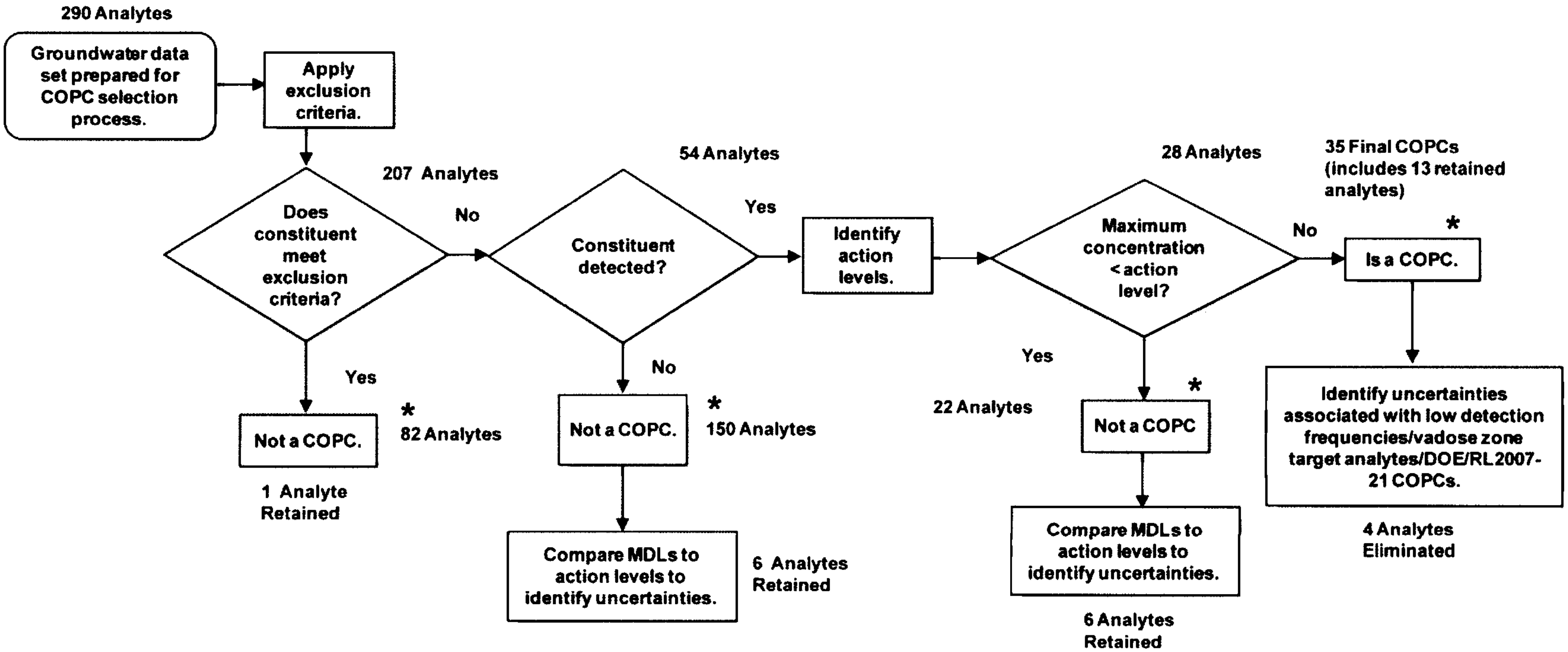
Analytes that meet exclusion criteria are eliminated as COPCs. Analytes that do not meet the exclusion criteria are carried forward into the next step of the process. The following define the exclusion criteria that are applied:

- Naturally-occurring radionuclides associated with background radiation
- Radionuclides with half-lives of less than 3 years and do not have "significant daughter products"
- Essential nutrients (minerals)
- Common laboratory contaminants
- Water quality parameters
- Analytes without no known toxicity information

D1.2.3.2 Identify Nondetected Analytes

Analytes that have been collected from appropriate locations, have adequate detection limits, and that have not been detected in any of the groundwater samples for an area are eliminated as COPCs. All analytes detected at least once are carried forward to the next step of the process.

Uncertainty Analysis. An additional evaluation was performed on those analytes that were reported with minimum and maximum method detection limits (MDLs) greater than their respective action level.



Note: * Review vadose zone soil target analytes to determine if groundwater COPCs should be added.

CHPUBS1004-19.21

Figure D1-2. COPC Selection – A Multi-Step Process

D1.2.3.3 Analytes with Maximum Detected Concentrations Less than Action Levels

Maximum concentrations of analytes detected in groundwater are compared to action levels to identify analytes that are not likely to significantly contribute to overall risk. If the maximum detected concentration of an analyte is less than its action level, the analyte is eliminated as a COPC unless the uncertainty analysis indicates otherwise.

Uncertainty Analysis. An additional evaluation was performed on those analytes that were detected at concentrations slightly less than their respective action level (i.e., the maximum detected concentration is at least one-tenth the action level or within one order of magnitude). The purpose of this evaluation is to determine if there is the potential for underestimating cumulative effects when concentrations of analytes are near but do not exceed the action level. Additionally, minimum and maximum MDLs associated with these analytes are evaluated to determine if they are adequate for confirming their presence or absence at their respective action levels. If the MDLs are greater than the action level and it is identified as a soil target analyte, then the analyte will be identified as a COPC.

D1.2.3.4 Identify Analytes with Maximum Detected Concentrations Greater than Action Levels

Maximum concentrations of analytes detected in groundwater are compared to action levels to identify analytes that are likely to contribute to overall risk. If the maximum detected concentration of an analyte is greater than its action level, the analyte is identified as a COPC unless the uncertainty analysis indicates otherwise.

Uncertainty Analysis. An additional evaluation was performed to distinguish those analytes that were detected infrequently and are not reproducible from those analytes that could be associated with a potential hot spot or localized area of contamination near a monitoring well.

D1.2.3.5 Final Evaluation of Groundwater COPCs

The final step is used to confirm the list of groundwater COPCs is consistent with what is known about Hanford Site operations and is compared to the vadose zone soil target analyte list and DOE/RL-2007-21, *Risk Assessment Report for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment.*

D1.3 Assumptions and Inputs

D1.3.1 Groundwater Set Used for COPC Selection

The analytical data set used in this evaluation was extracted from the HEIS database. Groundwater data for this analysis were obtained from monitoring wells and compliance wells. Although groundwater data collected from injection wells, extraction wells, and aquifer tubes can be used with monitoring and compliance data for purposes, such as remedy selection and design, these other data are not used for risk assessment.

A work plan to characterize the nature and extent of contamination in groundwater and associated potential exposures has not been written. Rather, the U.S. Department of Energy monitors groundwater at the Hanford Site to fulfill a variety of state and federal regulations, including the *Atomic Energy Act of 1954*, the *Resource Conservation and Recovery Act of 1976*, the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, and WAC 173-340. Data collected to fulfill monitoring requirements provide a comprehensive data set for identifying contaminants of potential concern (COPCs) in groundwater.

While they can be used for risk assessment, monitoring data do have associated uncertainties. The uncertainties associated with the groundwater data set are described in DOE/RL-2007-21, Volume 2. Specifically, the analytes, sampling frequencies, and method detection limits (or reporting limits) are used to meet different regulatory program requirements. Additionally, quality assurance and QC requirements can vary between programs. As a result, data may be flagged for suitability during validation and these flags may limit the use of the data. As a result of these differences, a consistent chemical "snapshot" of current groundwater conditions is needed.

The groundwater data set used for COPC selection consists of sampling and analysis data collected from a total of 162 monitoring wells from the 100-IU-2/IU-6 Groundwater Operable Unit (OU). Table D1-2 provides a list of the monitoring wells used in this evaluation. The sampling and analysis data were collected between January 21, 1992 and February 10, 2009. This groundwater data set includes groundwater samples collected since 1992. A limited field investigation was not performed for the 100-IU-2 and 100-IU-6 operable unit, however groundwater beneath these operable units are included within the boundaries of the 100-FR-3 groundwater operable unit. As stated previously, the data collected to fulfill monitoring requirements provide a comprehensive data set for identifying COPCs in groundwater. A total of 29,327 records were obtained from HEIS, and a total of 290 analytes are reported in this data set.

D1.4 Software Applications

Software used for this analysis included the HEIS database, Microsoft Access[1] database software, and Microsoft Excel.[2] HEIS is a central repository for storing and maintaining access to environmental data collected and analyzed for the Hanford Site. Microsoft Access was used query and sort the data downloaded from the HEIS database. Microsoft Excel was used to present the groundwater data and information in spreadsheets. No statistical calculations were performed.

D1.5 Calculation

D1.5.1 Apply Exclusion Criteria

A total of 80 of the 290 analytes meet the exclusion criteria and are listed in Table D1-3. Sampling dates, minimum and maximum detected concentrations, minimum and maximum MDLs, and the basis for their exclusion is provided in Table D1-3. The following define the exclusion criteria that are applied:

Background Radiation. Naturally-occurring radionuclides associated with background radiation (including potassium-40, radium-226, thorium-228, and thorium-232) were measured in groundwater from the 100-IU-2/IU-6 and are eliminated as COPCs.

Radionuclides with a half-life of less than three years and do not have Significant Daughter Products. Radioisotopes with half-lives less than or equal to three years are eliminated from further consideration because only a small fraction of activity remains after 30 years of decay. Sixteen radioisotopes met this exclusion criteria and are eliminated from further consideration as COPCs. Only ruthenium-106 was reported with measurable concentrations in groundwater, this isotope is not a significant daughter product of a decay chain and is therefore not identified as a groundwater COPC.

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[1] Access is a trademark of Microsoft Corporation, Redmond, Washington.

[2] Excel is a trademark of Microsoft Corporation, Redmond, Washington.

Essential Nutrients. Essential nutrients are those constituents considered essential for human nutrition. The essential nutrients (calcium, magnesium, potassium, and sodium) were measured in groundwater and are excluded from further consideration as COPCs.

Water Quality Parameters. Water quality parameters that represent physical and biological characteristics, such as temperature, pH, or turbidity, are eliminated as COPCs. In all cases, water quality parameters do not have available toxicological information and cannot be evaluated for exposure purposes. Fourteen water quality parameters were measured in groundwater from the 100-IU-2/IU-6 and are eliminated from further consideration as COPCs.

Common Laboratory Contaminants. Methylene chloride, acetone, and bis(2-ethylhexyl) phthalate are considered by EPA to be common laboratory contaminants. Common laboratory contaminants are introduced as a result of laboratory analysis procedures after the sample collection and are not related to the Hanford Site. Methylene chloride, acetone, and bis(2-ethylhexyl) phthalate were detected in groundwater at concentrations that would indicate they are common laboratory contaminants, therefore they are eliminated from further consideration as COPCs.

Analytes with no known Toxicity Information. Analytes with no known toxicity information are eliminated as COPCs. Forty-two analytes are eliminated because toxicity information is not available. The analytes that do not have toxicity information represent some analytes that have been detected in groundwater and other that have not been detected. A total of 31 analytes without toxicity information have not been detected (one metal, one pesticide, two radioisotopes, 13 semivolatile organic compounds, and 13 volatile organic compounds). The remaining 11 analytes were detected at least once (one metal, five radioisotopes, and five water quality parameters).

With the exception of gross beta and two pesticides (endrin ketone and delta-hexachlorocyclohexane [BHC]), the analytes eliminated as COPCs are wet chemistry parameters, volatile organic compounds, or semivolatile organic compounds that are opportunistically reported with an analytical suite and are not known to be associated with historical operations at the Hanford Site.

Although the uranium isotopes do not have a promulgated MCL they do have toxicity information available. The uranium isotopes were detected at concentrations ranging from less than 1 pCi/L to 2.2 pCi/L. Uranium isotopes are not identified as COPCs because the MCL for uranium (metal) is considered protective of kidney toxicity and carcinogenicity. All uranium isotope concentrations are below the proposed MCL value of 20 pCi/L. Total uranium (metal) is not identified as a COPC for 100-IU2/IU6.

Selenium-79 has available toxicity information but does not have an published federal MCLs for comparison purposes. Additionally this isotope was not detected in groundwater therefore it is not identified as a groundwater COPC.

Gross beta is frequently analyzed in groundwater samples as an indicator parameter. The standard for beta particles and photon emitters is 4 mrem/yr combined. The maximum gross beta concentration is 240 μg/L indicating the presence of beta emitters such as strontium-90. Strontium-90 has been identified as a groundwater COPC. Gross beta is not identified as a groundwater COPC; but will be analyzed for groundwater samples.

Endrin ketone was not detected in groundwater and does not have an action level. Endrin and endrin aldehyde are structurally similar to endrin ketone and have action levels. Endrin and endrin aldehyde have not been detected in groundwater and their minimum MDLs were less than their action level. Gamma-BHC was not detected in groundwater and its minimum MDL was less than the action level. Based on these comparisons, endrin ketone and delta-BHC are not present in groundwater at levels at or near a similar action level and are not identified as COPCs.

D1.5.2 Identify Nondetected Analytes

Of the 290 analytes, 153 analytes have not been detected in the 100-IU-2/IU-6 and are listed in Table D1-4. Table D1-4 also provides sampling dates, minimum and maximum MDLs, the action level, basis of the action level, and the level of exceedance. The minimum MDL is divided by the action level to determine the level of exceedance. The purpose of determining the minimum level of exceedance is to identify those analytes with MDLs that have not met the action level to date versus those analytes with MDLs that have met the action level at least some of the time.

One metal, seven polychlorinated biphenyls (PCB), 21 pesticides, nine radioisotopes, 61 semivolatile organic compounds, total petroleum hydrocarbons-diesel range, 50 volatile organic compounds, and three wet chemistry parameter were analyzed but have not been detected and are not considered COPCs.

Total petroleum hydrocarbon (TPH) –diesel range was reported as nondetect with an MDL greater than its action level. A comparison of the MDL between historical and current analytical methods indicates that a lower MDL can be attained. However, because TPH–diesel range was only analyzed one time and is identified as a vadose zone soil target analyte, TPH–diesel range is identified as a COPC.

D1.5.2.1 Uncertainty Analysis

A total of 53 analytes were reported with minimum MDLs greater than their respective action level. This indicates that the analytical method selected is unable to detect the analyte at or below the action level.

Europium-152, europium-154, europium-155, neptunium-237, plutonium-238, plutonium-239, plutonium-239/240, protactinium-231 and radium-228 were not detected in any groundwater sample. The europium isotopes and radium-228 are beta emitters, these constituents are identified as groundwater COPCs to determine their contribution to the gross beta standard of 4 mrem/yr. Neptunium-237, protactinium-231, and the plutonium isotopes are alpha emitting isotopes. Gross alpha is not identified as a COPC for groundwater; but will be analyzed to confirm that alpha emitters do not exceed the overall standard. Gross alpha was detected only once above the 15 pCi/L MCL supporting the absence of alpha emitting isotopes.

Twenty-four semivolatile organic compounds (SVOCs) were reported with MDLs greater than their action level. With the exception of polynuclear aromatic hydrocarbons (PAHs), the remainder of the SVOCs are not known or suspected to be associated with Hanford Site operations. Seven of the 16 PAHs reported have not been detected in groundwater but their minimum MDLs are approximately 2,600 times greater than their respective action levels. EPA Method 8270 (SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B)* currently is used to analyze for PAHs in groundwater. A comparison of MDLs between the historic and current analytical methods show no difference in MDLs. This indicates that the current analytical method cannot attain MDLs at the action level and would not reduce the uncertainties associated with the ability to confirm the analytes presence at or below the action levels. Generally, PAHs are immobile in soil and are not expected to migrate from vadose zone into groundwater. However, lower molecular weight PAHs such as acenaphthene, anthracene, fluorine, and naphthalene have the potential to be more mobile than higher molecular weight PAHs. Additionally, PAHs can form hydrophobic bonds to co-located organic which also creates the potential to mobilize PAHs. Because nine of the 16 PAHs reported achieved MDLs less than their respective action level suggests the overall absence of PAHs in groundwater, therefore PAHs are not expected to be present in groundwater and are not identified as COPCs.

Six volatile organic compounds (VOCs) were reported with MDLs greater than their respective action level. With the exception of vinyl chloride and 1,1-dichloroethene, the analytes reported are not known or suspected to be associated with Hanford site operations. Vinyl chloride and 1,1-dichloroethene are potential breakdown products of trichloroethene (TCE) and could potentially be present in groundwater. All MDLs associated with vinyl chloride are greater than the action level of 0.025 µg/L. Vinyl chloride is identified as a groundwater COPC to determine if nondetected concentrations are less than action levels. Fifty of the 56 MDLs reported for 1,1-dichloroethene are greater than the action level of 0.073 µg/L. 1,1-Dichloroethene is identified as a groundwater COPC to determine if nondetected concentrations are less than action levels.

Seven PCBs were reported with MDLs greater than their respective action levels. PCBs have been associated with some Hanford Site operations. The PCB MDLs ranged from 7,812 to 15,625 times greater than their respective action levels. EPA Method 8082 currently is used to analyze for PCBs in groundwater. A comparison of MDLs between historic and current analytical methods show little to no difference in MDLs. This indicates that current analytical method cannot attain MDLs at the action level and would not reduce the uncertainties associated with the ability to confirm the analytes presence at or below the action levels. Generally, PCBs are immobile in soil and are not expected to migrate from the vadose zone into groundwater; therefore, PCBs are not expected to be present in groundwater and are not identified as COPCs.

Twelve pesticides were reported with MDLs greater than their respective action levels. Pesticides have been applied in accordance with application requirements to areas within 100-IU-2/IU-6. Pesticide MDLs ranged from slightly greater than one to 1,650 times greater than the action levels. EPA Method 8081 is currently used to analyze for pesticides in groundwater. A comparison of MDLs between historic and current analytical methods show little to no difference in MDLs. This indicates that current analytical methods cannot attain MDLs at the action level and would not reduce the uncertainties associated with the ability to confirm the analytes presence at or below the action levels. Several pesticides are identified as vadose zone soil target analytes, however pesticides are generally immobile in soil therefore, pesticides are not identified as COPCs.

Three wet chemistry parameters (hydrazine, perchlorate anion, and sulfide) were reported with MDLs greater than their respective action levels. These wet chemistry parameters are not known to be persistent in the environment. Wet chemistry parameter MDLs range approximately 19 to 200 times greater than their respective action levels. Hydrazine, perchlorate ion, and sulfide are not identified as vadose zone soil target analytes. Because these analytes are not known to be persistent in the environment and are not identified as vadose zone target analytes, these analytes are not identified as COPCs.

D1.5.3 Analytes with Maximum Detected Concentrations Less Than Action Levels

TableD1-5 presents a summary of the analytes with maximum detected concentrations less than their respective action level. Twenty-nine analytes were detected at least once, but their maximum detected concentrations are less than their respective action levels. The level of exceedance associated with this group of analytes ranged from 0.92 to 1.69E-04. The maximum detected concentration is divided by the action level to determine the amount the action level was not exceeded. An additional consideration for inclusion as a COPC is the abundance of analytical results to determine the presence of an analyte or radioisotope.

D1.5.3.1 Uncertainty Analysis

The analytes with maximum detected concentrations greater than one-tenth of their respective action level are 1,1,2-trichloroethane, 1,1-dichloroethane, 1,2-dichloroethane, 1,4-dichlorobenzene, barium, beryllium, carbon-14, chloride, chloroform, chloromethane, chromium, cobalt-60, selenium, silver, sulfate, technetium-99, uranium, and vanadium. 1,1,2-Trichloroethane, 1,1-dichloroethane, 1,2-dichloroethane, 1,4-dichlorobenzene, chloroform, chloromethane, and selenium are reported with maximum MDLs greater than their respective action levels.

1,1,2-Trichloroethane. 1,1,2-Trichloroethane was detected in three of 115 samples (2.6 percent frequency) collected between 1992 and 2008. Of the 112 nondetected results, 52 MDLs were greater than the action level and 60 MDLs were less than the action level of 0.59 µg/L. 1,1,2-Trichloroethane is not identified as a vadose zone target analyte and is not identified as a contaminant of concern in DOE/RL-2007-21. Based on the results of this evaluation, 1,1,2-Trichloroethane is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

1,1-Dichloroethane. 1,1-Dichloroethane was detected in two of 155 water samples (1.3 percent frequency) collected between 1992 and 2008. Of the 153 nondetected results, 61 MDLs were greater than the action level and 92 MDLs were less than the action level of 0.55 µg/L. 1,1-Dichloroethane is not identified as a vadose zone target analyte and is not identified as a contaminant of concern in DOE/RL-2007-21. Based on the results of this evaluation, 1,1-dichloroethane is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

1,2-Dichloroethane. 1,2-Dichloroethane was detected in one of 155 water samples (0.65 percent frequency) collected between 1992 and 2008. Of the 154 nondetected results, 66 MDLs were greater than the action level and 88 MDLs were less than the action level of 0.38 µg/L. 1,2-Dichloroethane is not identified as a vadose zone target analyte and is not identified as a contaminant of concern in DOE/RL-2007-21. Based on the results of this evaluation, 1,2-dichloroethane is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

1,4-Dichlorobenzene. 1,4-Dichlorobenzene was detected in three of 105 water samples (2.9 percent frequency) collected between 1992 and 2008. Of the 102 nondetected results, 22 MDLs were greater than the action level and 80 MDLs were less than the action level of 1.82 µg/L. 1,4-Dichlorobenzene is not identified as a vadose zone target analyte and is not identified as a contaminant of concern in DOE/RL-2007-21. Based on the results of this evaluation, 1,4-dichlorobenzene is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Barium. Barium was detected in 140 of 142 water samples (99 percent frequency) collected between 1992 and 2008. All detected concentrations and MDLs are consistently below the action level of 1,000 µg/L. Based on the results of this evaluation, barium is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Beryllium. Beryllium was detected in 12 of 137 water samples (8.8 percent frequency) collected between 1992 and 2008. All detected concentrations and MDLs are consistently below the action level of 4 µg/L. Based on the results of this evaluation, beryllium is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Carbon-14. Carbon-14 was detected in three of 50 water samples (6.0 percent frequency) collected between 1992 and 1996. All detected concentrations and MDLs are consistently below the action level of 2,000 pCi/L. Based on the results of this evaluation, beryllium is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Chloride. Chloride was detected in all water samples collected between 1992 and 2008. All detected concentrations are consistently below the action level. Based on the results of this evaluation, chloride is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Chloroform. Chloroform was detected in 14 of 155 water samples (9.0 percent frequency) collected between 1992 and 2008. Of the 141 nondetected results, 27 MDLs were greater than and 92 MDLs were less than the action level of 5.7 µg/L. Twenty-two nondetected results were flagged with a "U" but were not reported with an MDL value. Because chloroform is identified as a vadose zone soil target analyte and is expected to be present in soil and some MDLs are greater than the action level, chloroform is identified as a COPC.

Chloromethane. Chloromethane was detected in one of 38 water samples (2.6 percent frequency) collected between 1992 and 2008. Of the 37 nondetected results, 31 MDLs are greater than and six MDLs are less than the action level of 3.37 µg/L. Chloromethane is not identified as a vadose zone target analyte. Based on the results of this evaluation, chloromethane is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Chromium. Chromium was detected 69 of 142 water samples (49 percent frequency) collected between 1992 and 2008. All detected concentrations and MDLs are consistently less than the action level of 74 µg/L. Based on the results of this evaluation, chromium is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Cobalt-60. Cobalt-60 was detected in 35 of 189 water samples (19 percent frequency) collected between 1992 and 2008. All detected concentrations and MDLs are consistently less than the action level of 100 pCi//L. Based on the results of this evaluation, cobalt-60 is eliminated from considerations as a COPC and its exclusion would not underestimate overall cumulative effects.

Selenium. Selenium was detected in 13 of 42 water samples (31 percent frequency) collected between 1992 and 1995. Of the 29 nondetected results, six MDLs were greater than and 23 MDLs were less than the action level of 5 µg/L. Based on the results of this evaluation, selenium is eliminated from considerations as a COPC and its exclusion would not underestimate overall cumulative effects.

Silver. Silver was detected in five of 137 water samples (3.7 percent frequency) collected between 1992 and 2008. All detected concentrations and MDLs are consistently below the action level of 80 µg/L. Based on the results of this evaluation, silver is eliminated from considerations as a COPC and its exclusion would not underestimate overall cumulative effects.

Sulfate. Sulfate was detected in 688 of 690 samples collected between 1992 and 2008. All detected concentrations and MDLs are consistently below the action level. Based on the results of this evaluation, sulfate is eliminated from consideration as a COPC and its exclusion would not underestimate overall cumulative effects.

Technetium-99. Technetium-99 was detected in 195 of 239 samples (82 percent frequency) collected between 1992 and 2008. All concentrations and MDLs are consistently below the action level of 900 pCi/L. Based on the results of this evaluation, technetium-99 is eliminated from consideration as a COPC and its exclusion would not underestimate overall cumulative effects.

Uranium. Uranium was detected in all 28 water samples collected between 1992 and 2008. All detected concentrations are consistently below the action level of 30 µg/L. Based on the results of this evaluation, uranium is eliminated from further consideration as a COPC and its exclusion would not underestimate overall cumulative effects.

Vanadium. Vanadium was detected in 110 of 135 samples (81 percent frequency) collected between 1992 and 2008. All concentrations and MDLs are consistently below the action level of 112 µg/L. Based on the results of this evaluation, vanadium is eliminated from further consideration as a COPC and its exclusion would not underestimate overall cumulative effects.

Americium-241 is an alpha-emitting isotope that has been detected in groundwater. Carbon-14, cesium-137, cobalt-60, and technetium-99 are beta emitting isotopes that have been detected in groundwater. Most of the isotopes do not have current analytical results for this operable unit; therefore, these radioisotopes are identified as groundwater COPCs to determine the amount these isotopes contribute to the 15 pCi/L standard for alpha emitters and the 4 mem/yr standard for beta emitters.

D1.5.4 Identify Analytes with Maximum Detected Concentrations Greater than Action Levels

Twenty-eight of the 290 analytes were detected at least once and their maximum detected concentrations are greater than their respective action levels. Table D1-6 provides a summary of the analytes with maximum detected concentrations greater than their respective action level. An uncertainty analysis was performed to distinguish analytes that are infrequently detected and are not reproducible from those that could be associated with a potential hot spot or localized area of contamination near a monitoring well.

D1.5.4.1 Uncertainty Analysis

Eight analytes (benzene, cadmium, carbon tetrachloride, cobalt, mercury, nitrite, tetrachloroethene, and thallium) are detected at low frequencies (i.e., less than five percent).

Benzene. Benzene was detected in three of 155 samples (1.9 percent frequency) collected between 1992 and 2008. Benzene was detected in three monitoring wells at concentrations above the action level during 1992 and 1993. Benzene was detected in monitoring well 699-37-E1 (B01N32) at a concentration of 5.2 ug/L during 1992 however no other sampling rounds were conducted at this location. Benzene was detected in well 699-43-88 (B07PT9) at concentration of 3 ug/L flagged with "J" and "B" qualifiers during 1993 but was not detected in the single previous sampling round at this location. Benzene was detected in well 699-65-72 (B07QZ9) at a concentration of 2 ug/L and flagged with a "J" qualifier during 1992 but was not detected in the two previous or two subsequent sampling rounds at this location. Of the 152 nondetected results, 37 MDLs were greater than and 92 MDLs were less than the action level of 0.795 µg/L. Twenty-three nondetected results were flagged with a "U" but were not reported with an MDL value. Benzene is not identified as a vadose zone soil target analyte and is not expected to be present in soil. However, benzene was detected at concentrations greater than the action limit and some of the MDLs for benzene are greater than the action level, therefore benzene is identified as a groundwater COPC.

Cadmium. Cadmium was detected in four of 142 samples (2.8 percent frequency) analyzed at concentrations above the action level. Cadmium was detected in three monitoring wells, 699-65-72 (B07QZ9 and B07ZR2), 699-70-68 (B07QT4), and 699-63-90 (B07ZQ7), at concentrations greater than the action level. Of the 138 nondetected results, 125 MDLs were greater than and 13 MDLs were less than the action level of 0.25 µg/L. Cadmium is identified as a vadose zone soil target analyte and could be present in soil or groundwater. Cadmium is identified as a COPC because it is detected in groundwater, most of the MDLs are greater than the action level, and it is identified as a vadose zone target analyte.

Carbon tetrachloride. Carbon tetrachloride was detected in seven of 155 samples (4.5 percent frequency) collected between 1992 and 2008. Carbon tetrachloride was detected in six monitoring wells at concentrations greater than the action level of 0.23 µg/L. Carbon tetrachloride was detected in well 699-66-23 (B0J8Q2) at a concentration of 33 µg/L during 1996; this analyte was not detected in five previous or three subsequent sampling rounds at this location. Carbon tetrachloride was detected in well 699-55-89 (B0J3X9) at a concentration of 2.5 µg/L during 1996; this analyte was not detected in five subsequent sampling rounds at this location. Carbon tetrachloride was detected in Well 699-62-43F (B0FZ81) at a concentration of 1.0 µg/L during 1995; this analyte was not detected in two previous or single subsequent sampling rounds at this location. Carbon tetrachloride was detected in Well 699-63-90 (B0H2H8) at a concentration of 0.48 µg/L during 1995; this analyte was not detected in four previous or four subsequent sampling rounds at this location. Carbon tetrachloride was detected in Well 699-32-22A (B1H780) at a concentration of 0.44 µg/L during 2006. Carbon tetrachloride was detected in Well 699-43-89 (B0HNF2) at a concentration of 0.34 µg/L during 1996. Of the 148 nondetected results, 82 MDLs were greater than and 78 were less than the action level of 0.23 µg/L. Carbon tetrachloride is not identified as a vadose zone soil target analyte and is not expected to be present in soil. Carbon tetrachloride is identified as a COPC because most of the MDLs are greater than the action level.

Cobalt. Cobalt was detected in five of 135 samples (3.7 percent frequency) collected between 1992 and 2008. Cobalt was detected in three monitoring wells at concentrations greater than the action level of 4.8 µg/L. Cobalt was detected during 1993 in Well 699-60-57 (B09543) at a concentration of 14.2 µg/L flagged with a "B" qualifier; it was not detected in two previous or one subsequent sampling round at this location. Cobalt was detected during 1994 in Well 699-71-30 (B0C225) at a concentration of 8.8 µg/L flagged with a "L" qualifier; it was not detected in one previous or six subsequent sampling rounds at this location. Cobalt was detected once at Well 699-83-47 (B1PVN8) at a concentration of 4.9 µg/L during 2007; it was not detected in six previous sampling rounds at this location. Of the 130 nondetected results, 26 MDLs were greater than and 91 MDLs were less than the action level of 4.8 µg/L. Thirteen nondetected results were reported without an MDL concentration value. Cobalt is identified as a COPC because it is detected at concentrations exceeding the action level, some of its MDLs are reported above the action limit, and it is identified as a vadose zone COPC.

Mercury. Mercury was detected in two of 76 samples (2.6 percent frequency) collected between 1992 and 2003. Mercury was detected in two monitoring wells at concentrations greater than the action level of 0.012 µg/L. Mercury was detected in 1992 in well 699-65-72 (B070D7) at a concentration of 0.25 µg/L flagged with a "J" qualifier; it was not detected in nine subsequent sampling rounds at this location. Mercury was detected in 1993 in well 699-72-92 (B07ZT7) at a concentration of 0.11 µg/L flagged with a "B" qualifier; it was not detected in one previous and six subsequent sampling rounds at this location. All 74 nondetected results were reported with MDLs greater than the action level of 0.012 µg/L. Mercury is identified as a COPC because it was detected at concentration greater than the action level, all MDLs are greater than the action level, and it is identified as a vadose zone target analyte.

Nitrite. Nitrite was detected in 20 of 627 samples (3.2 percent frequency) collected between 1992 and 2008. Nitrite was detected in two monitoring wells at concentrations greater than the action level of 1,000 µg/L. Nitrite was detected in monitoring well 699-17-5 at a concentration of 4,270 µg/L and flagged with a "D" during 2001, however nitrite was either not detected or detected at concentrations less than the action level during the 14 previous and one subsequent sampling round at this location. Nitrite was detected in monitoring well 699-20-20 at a concentration of 1,100 µg/L during 1992; however nitrite was not detected in the two previous and 15 subsequent sampling rounds at this location. All MDLs for nitrite are less than the action level. Nitrite is not identified as a vadose zone soil target analyte and is not expected to be present in soil. Nitrite is not identified as a COPC because concentrations above the action level are considered anomalous, all MDLs are less than the action level, and it is not identified as a vadose zone target analyte.

Tetrachloroethene. Tetrachloroethene was detected in two of 155 samples (1.3 percent frequency) collected between 1992 and 2008. Tetrachloroethene was detected in two monitoring wells at concentrations greater than the action level of 0.081 µg/L. Tetrachloroethene was detected in Well 699-43-89 (B0HNF2) at a concentration of 0.32 µg/L during 1996; however it was not detected in the six subsequent sampling rounds conducted at this location. Tetrachloroethene was detected in Well 699-20-20 (B0HBG4) at a concentration of 0.18 µg/L and flagged with an "L" during 1996; however it was not detected in the one previous sampling round conducted at this location. Of the 153 nondetected results, 143 MDLs were greater than and 11 MDLs were less than the action level of

0.081 µg/L. Tetrachloroethene is identified as a vadose zone soil target analyte and is expected to be present in soil. Tetrachloroethene is identified as a COPC because tetrachloroethene is infrequently detected over the action level, most of the MDLs are greater than the action level, and it is identified as a vadose zone target analyte.

Thallium. Thallium was detected in one of 53 samples (1.9 percent frequency) collected between 1992 and 2008. Thallium was detected in Well 699-54-45A (B08B31) at a concentration of 1 µg /L. Of the 52 nondetected results, 49 MDLs were greater than and three MDLs were less than the action level of 0.24 µg /L. Thallium is not identified as a vadose zone soil target analyte and is not expected to be present in soil. Thallium is identified as a groundwater COPC to confirm that nondetected concentrations are below the action level.

D1.5.5 Final Evaluation of Groundwater COPCs

The last step of the COPC selection process is used to confirm the list of groundwater COPCs is consistent with what is known about Hanford Site operations and is compared to the vadose zone soil target analyte list and DOE/RL-2007-21.

Cyanide. Cyanide was detected eight times out of 58 reported results. The action limit was exceeded twice, once at well 699-61-62 and once at Well 699-64-62. Three subsequent sampling rounds at well 699-64-62 reported cyanide concentrations once below the action level and twice nondetectable. The seven previous and two subsequent sampling rounds at Well 699-61-62 reported cyanide below the either the MDL or the contract required detection limit. The presence of cyanide at levels above action limits is not consistent, therefore, cyanide is not identified as a groundwater COPC.

Gross Alpha. Gross alpha is frequently analyzed in groundwater samples as an indicator parameter. Gross alpha is not identified as a COPC for groundwater; but will be analyzed to confirm alpha emitters do not exceed the overall standard.

Aluminum and Iron. Aluminum and iron were analyzed for and detected in groundwater samples collected from 1992 through 2008. Although maximum detected concentrations of aluminum and iron are greater than their action levels, which are secondary MCLs, the presence of these metals are likely to be naturally occurring. Because aluminum and iron are not identified as target analytes for vadose zone soil and are not identified as contaminants of concern in DOE/RL-2007-21, they are not identified as COPCs.

D1.6 Results

D1.6.1 Summary of Final COPCs

Table D1-7 identifies the COPCs for 100-IU-2/IU-6 groundwater, proposed analytical methods, their contract-required detection limits (CRDLs), action levels, and action level basis.

Thirty-five analytes have been identified as COPCs for IU-2/IU-6 groundwater. This list reflects the analytes most likely to contribute to overall risk within the 100-IU-2/IU-6. The groundwater data set represents a comprehensive data set for defining the COPCs as it includes groundwater data collected between 1992 and 2008. The groundwater COPCs have been compared to the target analytes identified for vadose zone soil in the 100-IU-2/IU-6 and to the groundwater contaminants of concern identified in DOE/RL-2007-21.

A selection process for target analytes in vadose zone soil has been conducted in coordination with this process for selecting COPCs in groundwater. The target analytes identified for vadose zone soil is based on an approach that was developed during the D/H systematic planning effort by Uncertainty Team No. 1 with participation from the Washington Department of Ecology, Fluor Hanford, and Washington Closure

Hanford. Target analytes selection process relies on the review of remediation and characterization information (historic and current) and the identification of appropriate information sources, such as limited field investigation reports, interim action records of decision, cleanup verification documents (Cleanup Verification Packages, Remaining Sites Verification Packages), and other pertinent documents.

DOE/RL-2007-21, Volume 2 includes a baseline risk assessment for each of the groundwater operable units in the 100 Area and 300 Area. The results of this risk assessment identified several uncertainties associated with the groundwater data set. DOE/RL-2007-21, Volume 2 is currently a draft document. Tritium is identified as a COPC for the IU-2/IU-6 Groundwater Operable Unit. This draft report also reports several analytes as uncertainties, including aluminum, arsenic, bis(2-ethylhexyl)phthalate, chloroform, di-n-octylphthalate, methylene chloride, uranium, uranium-233/234, and uranium-238. Analytes were identified with an uncertain status because a conclusion about COPC status was considered unsupportable and the data were considered suspect and inadequate to support risk assessment calculations.

Tritium was identified as a COPC in DOE/RL-2007-21, Volume 2 and is also identified as a groundwater COPC for 100-IU-2/IU-6.

Arsenic was reported with an uncertain COPC status and is identified as a COPC for 100-IU-2/IU-6.

Aluminum was reported with an uncertain COPC status and is not identified as a COPC because it is not identified as a vadose zone target analyte and it is considered naturally occurring in groundwater.

Bis(2-ethylhexyl)phthalate and methylene chloride were reported with an uncertain COPC status but are not identified as groundwater COPCs because they are considered common laboratory contaminants.

Di-n-octylphthalate was reported with an uncertain COPC status but was not detected in any groundwater sample and MDLs were below the action level of 320 µg/L.

Uranium, uranium-233/234, and uranium-238 were reported with an uncertain COPC status but are not identified as COPCs for the 100-IU-2/IU-6. Uranium concentrations were below the action level of 30 µg/L. Uranium isotopes do not have a promulgated action level and additionally their concentrations were below the proposed MCL of 20 pCi/L.

D1.7 References

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_09/40cfr141_09.html.

Atomic Energy Act of 1954, 42 USC 2011, et seq. Available at: http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0980/ml022200075-vol1.pdf.

Clean Water Act of 1977, 33 USC 1251, et seq. Available at: http://epw.senate.gov/water.pdf. (Note: see *Federal Water Pollution Control Act of 1972*. Available at: http://www.epa.gov/history/topics/fwpca/index.htm.)

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq. Available at: http://uscode.house.gov/download/pls/42C103.txt.

DOE/RL-2007-21, 2007, *Risk Assessment Report for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment*, Draft A, U.S. Department of Energy, Richland Operations, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0811240459. http://www5.hanford.gov/arpir/?content=findpage&AKey=0811240460. http://www5.hanford.gov/arpir/?content=findpage&AKey=0811240461.

Hanford Environmental Information System, Hanford Site database, Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: http://www.epa.gov/epawaste/inforesources/online/index.htm.

Safe Drinking Water Act of 1974, 42 USC 300, et seq. Available at: http://www.epa.gov/ogwdw/sdwa/.

SW-846, 2007, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*, as amended, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: www.epa.gov/SW-846/main.htm.

WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A.

WAC 173-340-720, "Model Toxics Control Act--Cleanup," "Ground Water Cleanup Standards," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-720.

WAC 173-340-730, "Model Toxics Control Act--Cleanup," "Surface Water Cleanup Standards," *Washington Administrative Code,* Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-730.

Table D1-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-IU2/IU6

CAS NO.	Analyte Name	Analyte Class	Units	Regional Screening Values - Residential Tap	Federal MCL or MCLG	WAC 173-201A	Freshwater CCC	Human Health Water + Organism	WAC 173-340-720 (4)	WAC 173-340-730(3)	Action Level	Action Level Basis
7429-90-5	Aluminum	METAL	ug/L	3.70E+04	5.00E+01	--	8.70E+01	--	1.60E+04	--	5.00E+01	Federal MCL
7440-36-0	Antimony	METAL	ug/L	1.50E+01	6.00E+00	--	--	5.60E+00	6.40E+00	1.04E+03	5.60E+00	Human Health Water + Organism
7440-38-2	Arsenic	METAL	ug/L	4.50E-02	1.00E+01	1.90E+02	1.50E+02	1.80E-02	5.83E-02	9.82E-02	1.80E-02	Human Health Water + Organism
7440-39-3	Barium	METAL	ug/L	7.30E+03	2.00E+03	--	--	1.00E+03	3.20E+03	--	1.00E+03	Human Health Water + Organism
7440-41-7	Beryllium	METAL	ug/L	7.30E+01	4.00E+00	--	--	--	3.20E+01	2.73E+02	4.00E+00	Federal MCL
7440-69-9	Bismuth	METAL	ug/L	--	--	--	--	--	--	--	--	--
7440-43-9	Cadmium	METAL	ug/L	1.80E+01	5.00E+00	--	2.50E-01	--	8.00E+00	2.03E+01	2.50E-01	Freshwater CCC
7440-70-2	Calcium	METAL	--	--	--	--	--	--	--	--	--	--
7440-47-3	Chromium	METAL	ug/L	5.50E+04	1.00E+02	--	7.40E+01	--	2.40E+04	2.43E+05	7.40E+01	Freshwater CCC
7440-48-4	Cobalt	METAL	ug/L	1.10E+01	--	--	--	--	4.80E+00	--	4.80E+00	WAC 173-340-720(4)
7440-50-8	Copper	METAL	ug/L	1.50E+03	1.30E+03	--	9.00E+00	1.30E+03	6.40E+02	2.88E+03	9.00E+00	Freshwater CCC
18540-29-9	Hexavalent Chromium	METAL	ug/L	1.10E+02	--	1.00E+01	1.10E+01	--	4.80E+01	4.86E+02	1.00E+01	WAC 173-201A
7439-89-6	Iron	METAL	ug/L	2.60E+04	3.00E+02	--	1.00E+03	3.00E+02	1.12E+04	--	3.00E+02	Federal MCL
7439-92-1	Lead	METAL	ug/L	--	1.50E+01	--	2.50E+00	--	--	--	2.50E+00	Freshwater CCC
7439-95-4	Magnesium	METAL	--	--	--	--	--	--	--	--	--	--
7439-96-5	Manganese	METAL	ug/L	8.80E+02	5.00E+01	--	--	5.00E+01	7.52E+02	--	5.00E+01	Federal MCL
7439-97-6	Mercury	METAL	ug/L	6.30E-01	2.00E+00	1.20E-02	--	--	4.80E+00	--	1.20E-02	WAC 173-201A
7440-02-0	Nickel	METAL	ug/L	7.30E+02	--	--	5.20E+01	6.10E+02	3.20E+02	1.10E+03	5.20E+01	Freshwater CCC
7440-09-7	Potassium	METAL	--	--	--	--	--	--	--	--	--	--
7782-49-2	Selenium	METAL	ug/L	1.80E+02	5.00E+01	5.00E+00	5.00E+00	1.70E+02	8.00E+01	2.70E+03	5.00E+00	Freshwater CCC
7440-21-3	Silicon	METAL	--	--	--	--	--	--	--	--	--	--
7440-22-4	Silver	METAL	ug/L	1.80E+02	1.00E+02	--	--	--	8.00E+01	2.59E+04	8.00E+01	WAC 173-340-720(4)
7440-23-5	Sodium	METAL	--	--	--	--	--	--	--	--	--	--
7440-24-6	Strontium	METAL	ug/L	2.20E+04	--	--	--	--	9.60E+03	--	9.60E+03	WAC 173-340-720(4)
7440-28-0	Thallium	METAL	ug/L	2.40E+00	2.00E+00	--	--	2.40E-01	1.12E+00	1.56E+00	2.40E-01	Human Health Water + Organism
7440-31-5	Tin	METAL	ug/L	2.20E+04	--	--	--	--	9.60E+03	--	9.60E+03	WAC 173-340-720(4)
7440-61-1	Uranium	METAL	ug/L	1.10E+02	3.00E+01	--	--	--	4.80E+01	--	3.00E+01	Federal MCL
7440-62-2	Vanadium	METAL	ug/L	2.60E+02	--	--	--	--	1.12E+02	--	1.12E+02	WAC 173-340-720(4)
7440-66-6	Zinc	METAL	ug/L	1.10E+04	5.00E+03	--	1.20E+02	7.40E+03	4.80E+03	1.65E+04	1.20E+02	Freshwater CCC
12674-11-2	Aroclor-1016	PCB	ug/L	9.60E-01	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
11104-28-2	Aroclor-1221	PCB	ug/L	6.80E-03	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
11141-16-5	Aroclor-1232	PCB	ug/L	6.80E-03	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
53469-21-9	Aroclor-1242	PCB	ug/L	3.40E-02	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
12672-29-6	Aroclor-1248	PCB	ug/L	3.40E-02	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
11097-69-1	Aroclor-1254	PCB	ug/L	3.40E-02	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
11096-82-5	Aroclor-1260	PCB	ug/L	3.40E-02	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
72-54-8	4,4'-DDD (Dichlorodiphenyldichloroethane)	PEST	ug/L	2.80E-01	--	--	--	3.10E-04	3.65E-01	5.04E-04	3.10E-04	Human Health Water + Organism
72-55-9	4,4'-DDE (Dichlorodiphenyldichloroethylene)	PEST	ug/L	2.00E-01	--	--	--	2.20E-04	2.57E-01	3.56E-04	2.20E-04	Human Health Water + Organism
50-29-3	4,4'-DDT (Dichlorodiphenyltrichloroethane)	PEST	ug/L	2.00E-01	--	1.00E-03	1.00E-03	2.20E-04	2.57E-01	3.56E-04	2.20E-04	Human Health Water + Organism
309-00-2	Aldrin	PEST	ug/L	4.00E-03	--	1.90E-03	--	4.90E-05	2.57E-03	8.16E-05	4.90E-05	Human Health Water + Organism
319-84-6	Alpha-BHC	PEST	ug/L	1.10E-02	--	--	--	2.60E-03	1.39E-02	7.91E-03	2.60E-03	Human Health Water + Organism
5103-71-9	Alpha-Chlordane	PEST	ug/L	--	--	--	4.30E-03	8.00E-04	2.50E-01	1.31E-03	8.00E-04	Human Health Water + Organism
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	PEST	ug/L	3.70E-02	--	--	--	9.10E-03	4.86E-02	2.77E-02	9.10E-03	Human Health Water + Organism
57-74-9	Chlordane	PEST	ug/L	--	--	4.30E-03	4.30E-03	8.00E-04	2.50E-01	1.31E-03	8.00E-04	Human Health Water + Organism
319-86-8	Delta-BHC	PEST	--	--	--	--	--	--	--	--	--	--
60-57-1	Dieldrin	PEST	ug/L	4.20E-03	--	1.90E-03	5.60E-02	5.20E-05	5.47E-03	8.67E-05	5.20E-05	Human Health Water + Organism
88-85-7	Dinoseb(2-secButyl-4,6-dinitrophenol)	PEST	ug/L	3.70E+01	7.00E+00	--	--	--	1.60E+01	--	7.00E+00	Federal MCL
959-98-8	Endosulfan I	PEST	ug/L	--	--	--	5.60E-02	6.20E+01	9.60E+01	5.76E+01	5.60E-02	Freshwater CCC
33213-65-9	Endosulfan II	PEST	ug/L	--	--	--	5.60E-02	6.20E+01	9.60E+01	5.76E+01	5.60E-02	Freshwater CCC
1031-07-8	Endosulfan sulfate	PEST	ug/L	--	--	--	--	6.20E+01	--	--	6.20E+01	Human Health Water + Organism

Table D1-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-IU2/IU6

CAS NO.	Analyte Name	Analyte Class	Units	Regional Screening Values - Residential Tap	Federal MCL or MCLG	WAC 173-201A	Freshwater CCC	Human Health Water + Organism	WAC 173-340-720 (4)	WAC 173-340-730(3)	Action Level	Action Level Basis
72-20-8	Endrin	PEST	ug/L	1.10E+01	2.00E+00	2.30E-03	3.60E-02	5.90E-02	4.80E+00	1.96E-01	2.30E-03	WAC 173-201A
7421-93-4	Endrin aldehyde	PEST	ug/L	--	--	--	--	2.90E-01	--	--	2.90E-01	Human Health Water + Organism
53494-70-5	Endrin ketone	PEST	--	--	--	--	--	--	--	--	--	--
58-89-9	Gamma-BHC (Lindane)	PEST	ug/L	6.10E-02	2.00E-01	8.00E-02	--	9.80E-01	6.73E-02	3.84E-02	3.84E-02	WAC 173-340-730(3)
76-44-8	Heptachlor	PEST	ug/L	1.50E-02	4.00E-01	3.80E-03	3.80E-03	7.90E-05	1.94E-02	1.29E-04	7.90E-05	Human Health Water + Organism
1024-57-3	Heptachlor epoxide	PEST	ug/L	7.40E-03	2.00E-01	--	3.80E-03	3.90E-05	4.81E-03	6.36E-05	3.90E-05	Human Health Water + Organism
72-43-5	Methoxychlor	PEST	ug/L	1.80E+02	4.00E+01	--	3.00E-02	1.00E+02	8.00E+01	8.36E+00	3.00E-02	Freshwater CCC
8001-35-2	Toxaphene	PEST	ug/L	6.10E-02	3.00E+00	2.00E-04	2.00E-04	2.80E-04	7.95E-02	4.50E-04	2.00E-04	Freshwater CCC
5103-74-2	trans-Chlordane	PEST	ug/L	--	--	--	4.30E-03	8.00E-04	2.50E-01	1.31E-03	8.00E-04	Human Health Water + Organism
14596-10-2	Americium-241	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
14234-35-6	Antimony-125	RAD	pCi/L	--	3.00E+02	--	--	--	--	--	3.00E+02	Federal MCL
14798-08-4	Barium-140	RAD	--	--	--	--	--	--	--	--	--	--
13966-02-4	Beryllium-7	RAD	--	--	--	--	--	--	--	--	--	--
14762-75-5	Carbon-14	RAD	pCi/L	--	2.00E+03	--	--	--	--	--	2.00E+03	Federal MCL
13967-74-3	Cerium-141	RAD	--	--	--	--	--	--	--	--	--	--
14762-78-8	Cerium-144	RAD	pCi/L	--	3.00E+01	--	--	--	--	--	3.00E+01	Federal MCL
13967-70-9	Cesium-134	RAD	pCi/L	--	8.00E+01	--	--	--	--	--	8.00E+01	Federal MCL
10045-97-3	Cesium-137	RAD	pCi/L	--	2.00E+02	--	--	--	--	--	2.00E+02	Federal MCL
14392-02-0	Chromium-51	RAD	--	--	--	--	--	--	--	--	--	--
13981-38-9	Cobalt-58	RAD	--	--	--	--	--	--	--	--	--	--
10198-40-0	Cobalt-60	RAD	pCi/L	--	1.00E+02	--	--	--	--	--	1.00E+02	Federal MCL
14683-23-9	Europium-152	RAD	pCi/L	--	2.00E+02	--	--	--	--	--	2.00E+02	Federal MCL
15585-10-1	Europium-154	RAD	pCi/L	--	6.00E+01	--	--	--	--	--	6.00E+01	Federal MCL
14391-16-3	Europium-155	RAD	pCi/L	--	6.00E+02	--	--	--	--	--	6.00E+02	Federal MCL
12587-46-1	Gross alpha	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
12587-47-2	Gross beta	RAD	--	--	--	--	--	--	--	--	--	--
15046-84-1	Iodine-129	RAD	pCi/L	--	1.00E+00	--	--	--	--	--	1.00E+00	Federal MCL
10043-66-0	Iodine-131	RAD	--	--	--	--	--	--	--	--	--	--
14596-12-4	Iron-59	RAD	--	--	--	--	--	--	--	--	--	--
13966-31-9	Manganese-54	RAD	pCi/L	--	3.00E+02	--	--	--	--	--	3.00E+02	Federal MCL
13994-20-2	Neptunium-237	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
13981-16-3	Plutonium-238	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
15117-48-3	Plutonium-239	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
PU-239/240	Plutonium-239/240	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
13966-00-2	Potassium-40	RAD	--	--	--	--	--	--	--	--	--	--
14331-85-2	Protactinium-231	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
13982-63-3	Radium-226	RAD	pCi/L	--	5.00E+00	--	--	--	--	--	5.00E+00	Federal MCL
15262-20-1	Radium-228	RAD	pCi/L	--	5.00E+00	--	--	--	--	--	5.00E+00	Federal MCL
13968-53-1	Ruthenium-103	RAD	--	--	--	--	--	--	--	--	--	--
13967-48-1	Ruthenium-106	RAD	pCi/L	--	3.00E+01	--	--	--	--	--	3.00E+01	Federal MCL
15758-45-9	Selenium-79	RAD	--	--	--	--	--	--	--	--	--	--
10098-97-2	Strontium-90	RAD	pCi/L	--	8.00E+00	--	--	--	--	--	8.00E+00	Federal MCL
14133-76-7	Technetium-99	RAD	pCi/L	--	9.00E+02	--	--	--	--	--	9.00E+02	Federal MCL
14274-82-9	Thorium-228	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
TH-232	Thorium-232	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
15065-10-8	Thorium-234	RAD	--	--	--	--	--	--	--	--	--	--
13966-06-8	Tin-113	RAD	--	--	--	--	--	--	--	--	--	--
10028-17-8	Tritium	RAD	pCi/L	--	2.00E+04	--	--	--	--	--	2.00E+04	Federal MCL
U-233/234	Uranium-233/234	RAD	--	--	--	--	--	--	--	--	--	--
13966-29-5	Uranium-234	RAD	--	--	--	--	--	--	--	--	--	--
15117-96-1	Uranium-235	RAD	--	--	--	--	--	--	--	--	--	--

Table D1-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-IU2/IU6

CAS NO.	Analyte Name	Analyte Class	Units	Regional Screening Values - Residential Tap	Federal MCL or MCLG	WAC 173-201A	Freshwater CCC	Human Health Water + Organism	WAC 173-340-720 (4)	WAC 173-340-730(3)	Action Level	Action Level Basis
U-238	Uranium-238	RAD	--	--	--	--	--	--	--	--	--	--
13982-39-3	Zinc-65	RAD	pCi/L	--	3.00E+02	--	--	--	--	--	3.00E+02	Federal MCL
13967-71-0	Zirconium-95	RAD	--	--	--	--	--	--	--	--	--	--
87-61-6	1,2,3-Trichlorobenzene	SVOC	--	--	--	--	--	--	--	--	--	--
120-82-1	1,2,4-Trichlorobenzene	SVOC	ug/L	8.20E+00	7.00E+01	--	--	3.50E+01	8.00E+01	2.27E+02	3.50E+01	Human Health Water + Organism
95-63-6	1,2,4-Trimethylbenzene	SVOC	ug/L	1.50E+01	--	--	--	--	8.00E+02	--	8.00E+02	WAC 173-340-720(4)
108-67-8	1,3,5-Trimethylbenzene	SVOC	ug/L	1.20E+01	--	--	--	--	--	--	1.20E+01	Regional Screening Values
106-46-7	1,4-Dichlorobenzene	SVOC	ug/L	4.30E-01	7.50E+01	--	--	6.30E+01	1.82E+00	4.86E+00	1.82E+00	WAC 173-340-720(4)
95-95-4	2,4,5-Trichlorophenol	SVOC	ug/L	3.70E+03	--	--	--	1.80E+03	8.00E+02	--	8.00E+02	WAC 173-340-720(4)
88-06-2	2,4,6-Trichlorophenol	SVOC	ug/L	6.10E+00	--	--	--	1.40E+00	3.98E+00	3.93E+00	1.40E+00	Human Health Water + Organism
120-83-2	2,4-Dichlorophenol	SVOC	ug/L	1.10E+02	--	--	--	7.70E+01	4.80E+01	1.91E+02	4.80E+01	WAC 173-340-720(4)
105-67-9	2,4-Dimethylphenol	SVOC	ug/L	7.30E+02	--	--	--	3.80E+02	3.20E+02	5.53E+02	3.20E+02	WAC 173-340-720(4)
51-28-5	2,4-Dinitrophenol	SVOC	ug/L	7.30E+01	--	--	--	6.90E+01	3.20E+01	3.46E+03	3.20E+01	WAC 173-340-720(4)
121-14-2	2,4-Dinitrotoluene	SVOC	ug/L	7.30E+01	--	--	--	1.10E-01	3.20E+01	1.36E+03	1.10E-01	Human Health Water + Organism
87-65-0	2,6-Dichlorophenol	SVOC	--	--	--	--	--	--	--	--	--	--
606-20-2	2,6-Dinitrotoluene	SVOC	ug/L	3.70E+01	--	--	--	--	1.60E+01	--	1.60E+01	WAC 173-340-720(4)
91-58-7	2-Chloronaphthalene	SVOC	ug/L	2.90E+03	--	--	--	1.00E+03	1.28E+03	1.03E+03	1.00E+03	Human Health Water + Organism
95-57-8	2-Chlorophenol	SVOC	ug/L	1.80E+02	--	--	--	8.10E+01	4.00E+01	9.67E+01	4.00E+01	WAC 173-340-720(4)
91-57-6	2-Methylnaphthalene	SVOC	ug/L	1.50E+02	--	--	--	--	3.20E+01	--	3.20E+01	WAC 173-340-720(4)
95-48-7	2-Methylphenol (cresol, o-)	SVOC	ug/L	1.80E+03	--	--	--	--	4.00E+02	--	4.00E+02	WAC 173-340-720(4)
88-74-4	2-Nitroaniline	SVOC	ug/L	--	--	--	--	--	2.40E+01	--	2.40E+01	WAC 173-340-720(4)
88-75-5	2-Nitrophenol	SVOC	--	--	--	--	--	--	--	--	--	--
91-94-1	3,3'-Dichlorobenzidine	SVOC	ug/L	1.50E-01	--	--	--	2.10E-02	1.94E-01	4.62E-02	2.10E-02	Human Health Water + Organism
65794-96-9	3+4 Methylphenol (cresol, m+p)	SVOC	--	--	--	--	--	--	--	--	--	--
108-39-4	3-Methylphenol (cresol, m-)	SVOC	ug/L	1.80E+03	--	--	--	--	4.00E+02	--	4.00E+02	WAC 173-340-720(4)
99-09-2	3-Nitroaniline	SVOC	ug/L	3.20E+00	--	--	--	--	2.08E+00	--	2.08E+00	WAC 173-340-720(4)
534-52-1	4,6-Dinitro-2-methylphenol	SVOC	ug/L	3.70E+00	--	--	--	1.30E+01	1.60E+00	--	1.60E+00	WAC 173-340-720(4)
101-55-3	4-Bromophenylphenyl ether	SVOC	--	--	--	--	--	--	--	--	--	--
59-50-7	4-Chloro-3-methylphenol	SVOC	ug/L	--	--	--	--	--	8.00E+02	--	8.00E+02	WAC 173-340-720(4)
106-47-8	4-Chloroaniline	SVOC	ug/L	1.20E+00	--	--	--	--	6.40E+01	--	6.40E+01	WAC 173-340-720(4)
7005-72-3	4-Chlorophenylphenyl ether	SVOC	--	--	--	--	--	--	--	--	--	--
106-44-5	4-Methylphenol (cresol, p-)	SVOC	ug/L	1.80E+02	--	--	--	--	4.00E+01	--	4.00E+01	WAC 173-340-720(4)
100-01-6	4-Nitroaniline	SVOC	ug/L	3.20E+00	--	--	--	--	2.08E+00	--	2.08E+00	WAC 173-340-720(4)
100-02-7	4-Nitrophenol	SVOC	ug/L	--	--	--	--	--	1.28E+02	6.27E+03	1.28E+02	WAC 173-340-720(4)
83-32-9	Acenaphthene	SVOC	ug/L	2.20E+03	--	--	--	6.70E+02	9.60E+02	6.43E+02	6.43E+02	WAC 173-340-730(3)
208-96-8	Acenaphthylene	SVOC	ug/L	--	--	--	--	--	9.60E+02	6.43E+02	6.43E+02	WAC 173-340-730(3)
120-12-7	Anthracene	SVOC	ug/L	1.10E+04	--	--	--	8.30E+03	2.40E+03	2.59E+04	2.40E+03	WAC 173-340-720(4)
56-55-3	Benzo(a)anthracene	SVOC	ug/L	2.90E-02	--	--	--	3.80E-03	1.20E-01	2.96E-01	3.80E-03	Human Health Water + Organism
50-32-8	Benzo(a)pyrene	SVOC	ug/L	2.90E-03	2.00E-01	--	--	3.80E-03	1.20E-02	2.96E-02	3.80E-03	Human Health Water + Organism
205-99-2	Benzo(b)fluoranthene	SVOC	ug/L	2.90E-02	--	--	--	3.80E-03	1.20E-01	2.96E-01	3.80E-03	Human Health Water + Organism
191-24-2	Benzo(ghi)perylene	SVOC	ug/L	--	--	--	--	--	4.80E+02	--	4.80E+02	WAC 173-340-720(4)
207-08-9	Benzo(k)fluoranthene	SVOC	ug/L	2.90E-01	--	--	--	3.80E-03	8.75E-01	2.16E+00	3.80E-03	Human Health Water + Organism
95-16-9	Benzothiazole	SVOC	--	--	--	--	--	--	--	--	--	--
108-60-1	Bis(2-chloro-1-methylethyl)ether	SVOC	ug/L	3.20E-01	--	--	--	1.40E+03	1.25E+00	3.75E+01	1.25E+00	WAC 173-340-720(4)
111-91-1	Bis(2-Chloroethoxy)methane	SVOC	ug/L	1.10E+02	--	--	--	--	3.98E-02	8.54E-01	3.98E-02	WAC 173-340-720(4)
111-44-4	Bis(2-chloroethyl) ether	SVOC	ug/L	1.20E-02	--	--	--	3.00E-02	3.98E-02	8.54E-01	3.00E-02	Human Health Water + Organism
117-81-7	Bis(2-ethylhexyl) phthalate	SVOC	ug/L	4.80E+00	6.00E+00	--	--	1.20E+00	6.25E+00	3.56E+00	1.20E+00	Human Health Water + Organism
85-68-7	Butylbenzylphthalate	SVOC	ug/L	3.50E+01	--	--	--	1.50E+03	3.20E+03	1.25E+03	1.25E+03	WAC 173-340-730(3)
86-74-8	Carbazole	SVOC	ug/L	--	--	--	--	--	4.38E+00	--	4.38E+00	WAC 173-340-720(4)
218-01-9	Chrysene	SVOC	ug/L	2.90E+00	--	--	--	3.80E-03	8.75E+00	2.16E+01	3.80E-03	Human Health Water + Organism
124-18-5	Decane	SVOC	--	--	--	--	--	--	--	--	--	--

Table D1-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-IU2/IU6

CAS NO.	Analyte Name	Analyte Class	Units	Regional Screening Values - Residential Tap	Federal MCL or MCLG	WAC 173-201A	Freshwater CCC	Human Health Water + Organism	WAC 173-340-720 (4)	WAC 173-340-730(3)	Action Level	Action Level Basis
53-70-3	Dibenz[a,h]anthracene	SVOC	ug/L	2.90E-03	--	--	--	3.80E-03	8.75E-01	2.16E+00	3.80E-03	Human Health Water + Organism
132-64-9	Dibenzofuran	SVOC	ug/L	--	--	--	--	--	3.20E+01	--	3.20E+01	WAC 173-340-720(4)
84-66-2	Diethylphthalate	SVOC	ug/L	2.90E+04	--	--	--	1.70E+04	1.28E+04	2.84E+04	1.28E+04	WAC 173-340-720(4)
60-51-5	Dimethoate	SVOC	ug/L	7.30E+00	--	--	--	--	3.20E+00	--	3.20E+00	WAC 173-340-720(4)
131-11-3	Dimethyl phthalate	SVOC	ug/L	--	--	--	--	2.70E+05	1.60E+04	7.20E+04	1.60E+04	WAC 173-340-720(4)
84-74-2	Di-n-butylphthalate	SVOC	ug/L	3.70E+03	--	--	--	2.00E+03	1.60E+03	2.91E+03	1.60E+03	WAC 173-340-720(4)
117-84-0	Di-n-octylphthalate	SVOC	ug/L	--	--	--	--	--	3.20E+02	--	3.20E+02	WAC 173-340-720(4)
112-40-3	Dodecane	SVOC	--	--	--	--	--	--	--	--	--	--
206-44-0	Fluoranthene	SVOC	ug/L	1.50E+03	--	--	--	1.30E+02	6.40E+02	9.02E+01	9.02E+01	WAC 173-340-730(3)
86-73-7	Fluorene	SVOC	ug/L	1.50E+03	--	--	--	1.10E+03	6.40E+02	3.46E+03	6.40E+02	WAC 173-340-720(4)
118-74-1	Hexachlorobenzene	SVOC	ug/L	4.20E-02	1.00E+00	--	--	2.80E-04	5.47E-02	4.66E-04	2.80E-04	Human Health Water + Organism
87-68-3	Hexachlorobutadiene	SVOC	ug/L	8.60E-01	--	--	--	4.40E-01	5.61E-01	2.99E+01	4.40E-01	Human Health Water + Organism
77-47-4	Hexachlorocyclopentadiene	SVOC	ug/L	2.20E+02	5.00E+01	--	--	4.00E+01	9.60E+01	3.58E+03	4.00E+01	Human Health Water + Organism
67-72-1	Hexachloroethane	SVOC	ug/L	4.80E+00	--	--	--	1.40E+00	3.13E+00	5.33E+00	1.40E+00	Human Health Water + Organism
193-39-5	Indeno(1,2,3-cd)pyrene	SVOC	ug/L	2.90E-02	--	--	--	3.80E-03	1.20E-01	2.96E-01	3.80E-03	Human Health Water + Organism
91-20-3	Naphthalene	SVOC	ug/L	1.40E-01	--	--	--	--	1.60E+02	4.94E+03	1.60E+02	WAC 173-340-720(4)
98-95-3	Nitrobenzene	SVOC	ug/L	3.40E+00	--	--	--	1.70E+01	1.60E+01	1.79E+03	1.60E+01	WAC 173-340-720(4)
621-64-7	n-Nitrosodi-n-dipropylamine	SVOC	ug/L	9.60E-03	--	--	--	5.00E-03	1.25E-02	8.19E-01	5.00E-03	Human Health Water + Organism
86-30-6	n-Nitrosodiphenylamine	SVOC	ug/L	1.40E+01	--	--	--	3.30E+00	1.79E+01	9.73E+00	3.30E+00	Human Health Water + Organism
87-86-5	Pentachlorophenol	SVOC	ug/L	5.60E-01	1.00E+00	--	1.50E+01	2.70E-01	7.29E-01	4.91E+00	2.70E-01	Human Health Water + Organism
85-01-8	Phenanthrene	SVOC	ug/L	--	--	--	--	--	2.40E+03	2.59E+04	2.40E+03	WAC 173-340-720(4)
108-95-2	Phenol	SVOC	ug/L	1.10E+04	--	--	--	2.10E+04	2.40E+03	5.56E+05	2.40E+03	WAC 173-340-720(4)
129-00-0	Pyrene	SVOC	ug/L	1.10E+03	--	--	--	8.30E+02	4.80E+02	2.59E+03	4.80E+02	WAC 173-340-720(4)
25167-83-3	Tetrachlorophenol	SVOC	--	--	--	--	--	--	--	--	--	--
629-59-4	Tetradecane	SVOC	--	--	--	--	--	--	--	--	--	--
1319-77-3	Total cresols	SVOC	--	--	--	--	--	--	--	--	--	--
126-73-8	Tributyl phosphate	SVOC	ug/L	7.30E+00	--	--	--	--	1.62E+01	--	1.62E+01	WAC 173-340-720(4)
25167-82-2	Trichlorophenol	SVOC	--	--	--	--	--	--	--	--	--	--
115-96-8	Tris-2-chloroethyl phosphate	SVOC	ug/L	4.80E+00	--	--	--	--	--	--	4.80E+00	Regional Screening Values
TPHDIESEL	Total petroleum hydrocarbons - diesel range	TPH	ug/L	--	--	--	--	Method A	5.00E+02	--	5.00E+02	WAC 173-340-720(3)
179601-23-1	(m+p)-Xylene	VOC	ug/L	2.00E+02	1.00E+04	--	--	--	1.60E+03	--	1.60E+03	WAC 173-340-720(4)
630-20-6	1,1,1,2-Tetrachloroethane	VOC	ug/L	5.20E-01	--	--	--	--	1.68E+00	--	1.68E+00	WAC 173-340-720(4)
71-55-6	1,1,1-Trichloroethane	VOC	ug/L	9.10E+03	2.00E+02	--	--	--	1.60E+04	9.26E+05	2.00E+02	Federal MCL
79-34-5	1,1,2,2-Tetrachloroethane	VOC	ug/L	6.70E-02	--	--	--	1.70E-01	2.19E-01	6.48E+00	1.70E-01	Human Health Water + Organism
79-00-5	1,1,2-Trichloroethane	VOC	ug/L	2.40E-01	5.00E+00	--	--	5.90E-01	7.68E-01	2.53E+01	5.90E-01	Human Health Water + Organism
75-34-3	1,1-Dichloroethane	VOC	ug/L	2.40E+00	--	--	--	5.50E-01	8.00E+02	--	5.50E-01	Human Health Water + Organism
75-35-4	1,1-Dichloroethene	VOC	ug/L	3.40E+02	7.00E+00	--	--	3.30E+02	7.29E-02	1.93E+00	7.29E-02	WAC 173-340-720(4)
563-58-6	1,1-Dichloropropene	VOC	--	--	--	--	--	--	--	--	--	--
96-18-4	1,2,3-Trichloropropane	VOC	ug/L	9.60E-03	--	--	--	--	6.25E-03	--	6.25E-03	WAC 173-340-720(4)
96-12-8	1,2-Dibromo-3-chloropropane	VOC	ug/L	3.20E-04	2.00E-01	--	--	--	3.13E-02	--	3.13E-02	WAC 173-340-720(4)
106-93-4	1,2-Dibromoethane	VOC	ug/L	6.50E-03	5.00E-02	--	--	--	4.38E-02	--	4.38E-02	WAC 173-340-720(4)
95-50-1	1,2-Dichlorobenzene	VOC	ug/L	3.70E+02	6.00E+02	--	--	4.20E+02	7.20E+02	4.20E+03	4.20E+02	Human Health Water + Organism
107-06-2	1,2-Dichloroethane	VOC	ug/L	1.50E-01	5.00E+00	--	--	3.80E-01	4.81E-01	5.94E+01	3.80E-01	Human Health Water + Organism
540-59-0	1,2-Dichloroethene (Total)	VOC	ug/L	3.30E+02	--	--	--	--	7.20E+01	--	7.20E+01	WAC 173-340-720(4)
78-87-5	1,2-Dichloropropane	VOC	ug/L	3.90E-01	5.00E+00	--	--	5.00E-01	6.43E-01	2.32E+01	5.00E-01	Human Health Water + Organism
541-73-1	1,3-Dichlorobenzene	VOC	ug/L	--	--	--	--	3.20E+02	2.40E+02	1.40E+03	2.40E+02	WAC 173-340-720(4)
142-28-9	1,3-Dichloropropane	VOC	ug/L	7.30E+02	--	--	--	--	--	--	7.30E+02	Regional Screening Values
123-91-1	1,4-Dioxane	VOC	ug/L	6.10E+00	--	--	--	--	3.98E+00	--	3.98E+00	WAC 173-340-720(4)
71-36-3	1-Butanol	VOC	ug/L	3.70E+03	--	--	--	--	8.00E+02	--	8.00E+02	WAC 173-340-720(4)
594-20-7	2,2-Dichloropropane	VOC	--	--	--	--	--	--	--	--	--	--
78-93-3	2-Butanone	VOC	ug/L	7.10E+03	--	--	--	--	4.80E+03	--	4.80E+03	WAC 173-340-720(4)

Table D1-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-IU2/IU6

CAS NO.	Analyte Name	Analyte Class	Units	Regional Screening Values - Residential Tap	Federal MCL or MCLG	WAC 173-201A	Freshwater CCC	Human Health Water + Organism	WAC 173-340-720 (4)	WAC 173-340-730(3)	Action Level	Action Level Basis
95-49-8	2-Chlorotoluene	VOC	ug/L	7.30E+02	--	--	--	--	1.60E+02	--	1.60E+02	WAC 173-340-720(4)
591-78-6	2-Hexanone	VOC	ug/L	--	--	--	--	0.00E+00	6.40E+02	--	6.40E+02	WAC 173-340-720(4)
108-10-1	2-Pentanone, 4-Methyl	VOC	ug/L	2.00E+03	--	--	--	--	6.40E+02	--	6.40E+02	WAC 173-340-720(4)
109-06-8	2-Picoline	VOC	--	--	--	--	--	--	--	--	--	--
67-63-0	2-Propanol	VOC	--	--	--	--	--	--	--	--	--	--
106-43-4	4-Chlorotoluene	VOC	ug/L	2.60E+03	--	--	--	--	--	--	2.60E+03	Regional Screening Values
67-64-1	Acetone	VOC	ug/L	2.20E+04	--	--	--	--	7.20E+03	--	7.20E+03	WAC 173-340-720(4)
75-05-8	Acetonitrile	VOC	ug/L	1.30E+02	--	--	--	--	--	--	1.30E+02	Regional Screening Values
107-02-8	Acrolein	VOC	ug/L	4.20E-02	--	--	--	1.90E+02	4.00E+00	6.03E+00	4.00E+00	WAC 173-340-720(4)
107-05-1	Allyl chloride	VOC	ug/L	2.10E+00	--	--	--	--	8.00E+02	--	8.00E+02	WAC 173-340-720(4)
71-43-2	Benzene	VOC	ug/L	4.10E-01	5.00E+00	--	--	2.20E+00	7.95E-01	2.27E+01	7.95E-01	WAC 173-340-720(4)
108-86-1	Bromobenzene	VOC	ug/L	2.00E+01	--	--	--	--	--	--	2.00E+01	Regional Screening Values
74-97-5	Bromochloromethane	VOC	--	--	--	--	--	--	--	--	--	--
75-27-4	Bromodichloromethane	VOC	ug/L	1.10E+00	--	--	--	5.50E-01	7.06E-01	2.79E+01	5.50E-01	Human Health Water + Organism
75-25-2	Bromoform	VOC	ug/L	8.50E+00	--	--	--	4.30E+00	5.54E+00	2.19E+02	4.30E+00	Human Health Water + Organism
74-83-9	Bromomethane	VOC	ug/L	8.70E+00	--	--	--	4.70E+01	1.12E+01	9.68E+02	1.12E+01	WAC 173-340-720(4)
75-15-0	Carbon disulfide	VOC	ug/L	1.00E+03	--	--	--	--	8.00E+02	--	8.00E+02	WAC 173-340-720(4)
56-23-5	Carbon tetrachloride	VOC	ug/L	2.00E-01	5.00E+00	--	--	2.30E-01	3.37E-01	2.66E+00	2.30E-01	Human Health Water + Organism
108-90-7	Chlorobenzene	VOC	ug/L	9.10E+01	1.00E+02	--	--	1.30E+02	1.60E+02	5.03E+03	1.30E+02	Human Health Water + Organism
75-00-3	Chloroethane	VOC	ug/L	2.10E+04	--	--	--	--	--	--	2.10E+04	Regional Screening Values
67-66-3	Chloroform	VOC	ug/L	1.90E-01	7.00E+01	--	--	5.70E+00	7.17E+00	2.83E+02	5.70E+00	Human Health Water + Organism
74-87-3	Chloromethane	VOC	ug/L	1.80E+00	--	--	--	--	3.37E+00	1.33E+02	3.37E+00	WAC 173-340-720(4)
126-99-8	Chloroprene	VOC	ug/L	1.40E+01	--	--	--	--	3.20E+02	--	3.20E+02	WAC 173-340-720(4)
156-59-2	cis-1,2-Dichloroethylene	VOC	ug/L	3.70E+02	7.00E+01	--	--	--	8.00E+01	--	7.00E+01	Federal MCL
10061-01-5	cis-1,3-Dichloropropene	VOC	ug/L	4.30E-01	--	--	--	3.40E-01	2.43E-01	1.89E+01	2.43E-01	WAC 173-340-720(4)
124-48-1	Dibromochloromethane	VOC	ug/L	8.00E-01	--	--	--	4.00E-01	5.21E-01	2.06E+01	4.00E-01	Human Health Water + Organism
74-95-3	Dibromomethane	VOC	ug/L	3.70E+02	--	--	--	--	8.00E+01	--	8.00E+01	WAC 173-340-720(4)
75-71-8	Dichlorodifluoromethane	VOC	ug/L	3.90E+02	--	--	--	--	1.60E+03	--	1.60E+03	WAC 173-340-720(4)
107-12-0	Ethyl cyanide	VOC	--	--	--	--	--	--	--	--	--	--
97-63-2	Ethyl methacrylate	VOC	ug/L	3.30E+03	--	--	--	--	7.20E+02	--	7.20E+02	WAC 173-340-720(4)
100-41-4	Ethylbenzene	VOC	ug/L	1.50E+00	7.00E+02	--	--	5.30E+02	8.00E+02	6.91E+03	5.30E+02	Human Health Water + Organism
110-54-3	Hexane	VOC	ug/L	8.80E+02	--	--	--	--	4.80E+02	--	4.80E+02	WAC 173-340-720(4)
74-88-4	Iodomethane	VOC	--	--	--	--	--	--	--	--	--	--
78-83-1	Isobutyl alcohol	VOC	ug/L	1.10E+04	--	--	--	--	2.40E+03	--	2.40E+03	WAC 173-340-720(4)
78-59-1	Isophorone	VOC	ug/L	7.10E+01	--	--	--	3.50E+01	4.61E+01	1.56E+03	3.50E+01	Human Health Water + Organism
98-82-8	Isopropylbenzene	VOC	ug/L	6.80E+02	--	--	--	--	1.60E+03	--	1.60E+03	WAC 173-340-720(4)
126-98-7	Methacrylonitrile	VOC	ug/L	1.00E+00	--	--	--	--	8.00E-01	--	8.00E-01	WAC 173-340-720(4)
80-62-6	Methyl methacrylate	VOC	ug/L	1.40E+03	--	--	--	--	1.12E+04	--	1.12E+04	WAC 173-340-720(4)
75-09-2	Methylene chloride	VOC	ug/L	4.80E+00	5.00E+00	--	--	4.60E+00	5.83E+00	9.60E+02	4.60E+00	Human Health Water + Organism
108-38-3	m-Xylene	VOC	ug/L	1.40E+03	--	--	--	--	1.60E+03	--	1.60E+03	WAC 173-340-720(4)
104-51-8	n-Butylbenzene	VOC	ug/L	--	--	--	--	--	3.20E+02	--	3.20E+02	WAC 173-340-720(4)
103-65-1	n-Propylbenzene	VOC	--	--	--	--	--	--	--	--	--	--
95-47-6	o-Xylene	VOC	ug/L	1.40E+03	--	--	--	--	1.60E+03	--	1.60E+03	WAC 173-340-720(4)
99-87-6	p-Cymene	VOC	--	--	--	--	--	--	--	--	--	--
106-42-3	p-Xylene	VOC	ug/L	1.50E+03	--	--	--	--	--	--	1.50E+03	Regional Screening Values
135-98-8	sec-Butylbenzene	VOC	--	--	--	--	--	--	--	--	--	--
100-42-5	Styrene	VOC	ug/L	1.60E+03	1.00E+02	--	--	--	1.46E+00	--	1.46E+00	WAC 173-340-720(4)
98-06-6	tert-Butylbenzene	VOC	--	--	--	--	--	--	--	--	--	--
127-18-4	Tetrachloroethene	VOC	ug/L	1.10E-01	5.00E+00	--	--	6.90E-01	8.10E-02	3.92E-01	8.10E-02	WAC 173-340-720(4)
109-99-9	Tetrahydrofuran	VOC	--	--	--	--	--	--	--	--	--	--
108-88-3	Toluene	VOC	ug/L	2.30E+03	1.00E+03	--	--	1.30E+03	6.40E+02	1.94E+04	6.40E+02	WAC 173-340-720(4)

Table D1-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-IU2/IU6

CAS NO.	Analyte Name	Analyte Class	Units	Regional Screening Values - Residential Tap	Federal MCL or MCLG	WAC 173-201A	Freshwater CCC	Human Health Water + Organism	WAC 173-340-720 (4)	WAC 173-340-730(3)	Action Level	Action Level Basis
156-60-5	trans-1,2-Dichloroethylene	VOC	ug/L	1.10E+02	1.00E+02	--	--	1.40E+02	1.60E+02	3.28E+04	1.00E+02	Federal MCL
10061-02-6	trans-1,3-Dichloropropene	VOC	ug/L	4.30E-01	--	--	--	3.40E-01	2.43E-01	1.89E+01	2.43E-01	WAC 173-340-720(4)
110-57-6	trans-1,4-Dichloro-2-butene	VOC	--	--	--	--	--	--	--	--	--	--
79-01-6	Trichloroethene	VOC	ug/L	1.70E+00	5.00E+00	--	--	2.50E+00	4.92E-01	6.87E+00	4.92E-01	WAC 173-340-720(4)
75-69-4	Trichloromonofluoromethane	VOC	ug/L	1.30E+03	--	--	--	--	2.40E+03	--	2.40E+03	WAC 173-340-720(4)
108-05-4	Vinyl acetate	VOC	ug/L	4.10E+02	--	--	--	--	8.00E+03	--	8.00E+03	WAC 173-340-720(4)
75-01-4	Vinyl chloride	VOC	ug/L	1.60E-02	2.00E+00	--	--	2.50E-02	2.92E-02	3.69E+00	2.50E-02	Human Health Water + Organism
1330-20-7	Xylenes (total)	VOC	ug/L	2.00E+02	1.00E+04	--	--	--	1.60E+03	--	1.60E+03	WAC 173-340-720(4)
ALKALINITY	Alkalinity	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
7664-41-7	Ammonia	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
24959-67-9	Bromide	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
COD	Chemical Oxygen Demand	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
COLIFORM	Coliform Bacteria	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
DO	Dissolved oxygen	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
EH	Oxidation Reduction Potential	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
PH	pH Measurement	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
CONDUCT	Specific Conductance	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
TEMPERATURE	Temperature	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
TDS	Total dissolved solids	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
TINC	Total Inorganic Carbon	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
TOC	Total organic carbon	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
59473-04-0	Total organic halides	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
TURBIDITY	Turbidity	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
16887-00-6	Chloride	WET CHEM	ug/L	--	2.50E+05	--	2.30E+05	--	--	--	2.30E+05	Freshwater CCC
57-12-5	Cyanide	WET CHEM	ug/L	7.30E+02	2.00E+02	5.20E+00	5.20E+00	1.40E+02	3.20E+02	5.19E+04	5.20E+00	Freshwater CCC
16984-48-8	Fluoride	WET CHEM	ug/L	2.20E+03	4.00E+03	--	--	--	9.60E+02	--	9.60E+02	WAC 173-340-720(4)
302-01-2	Hydrazine	WET CHEM	ug/L	2.20E-02	--	--	--	--	1.46E-02	--	1.46E-02	WAC 173-340-720(4)
7778-77-0	Monopotassium phosphate	WET CHEM	--	--	--	--	--	--	--	--	--	--
14797-55-8	Nitrate (ASN)	WET CHEM	ug/L	5.80E+04	1.00E+04	--	--	--	2.56E+04	--	1.00E+04	Federal MCL
14797-65-0	Nitrite (ASN)	WET CHEM	ug/L	3.70E+03	1.00E+03	--	--	--	1.60E+03	--	1.00E+03	Federal MCL
NO2+NO3-N	Nitrogen in Nitrite and Nitrate	WET CHEM	--	--	--	--	--	--	--	--	--	--
14797-73-0	Perchlorate anion	WET CHEM	ug/L	2.60E+01	--	--	--	--	--	--	2.60E+01	Regional Screening Value
14265-44-2	Phosphate	WET CHEM	--	--	--	--	--	--	--	--	--	--
7632-00-0	Sodium nitrite	WET CHEM	--	--	--	--	--	--	--	--	--	--
14808-79-8	Sulfate	WET CHEM	ug/L	--	2.50E+05	--	--	--	--	--	2.50E+05	Federal MCL
18496-25-8	Sulfide	WET CHEM	ug/L	--	--	--	2.00E+00	0.00E+00	--	--	2.00E+00	Freshwater CCC

WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington."
WAC 173-340-720(3), "Methos A Cleanup Levels for Potable Ground Water."
WAC 173-340-720(4), "Method B Cleanup Levels for Potable Ground Water."
WAC 173-340-730(3), "Method B Surface Water Cleanup Levels."
BHC = hexachlorocyclohexane
CAS = Chemical Abstracts Service
CCC = criteria continuous concentration
MCL = maximum contaminant level
PCB = polychlorinated biphenyls
PEST = pesticides
RAD = radiological
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound
WAC = Washington Administrative Code
WET CHEM = wet chemistry

Table D1-2. Summary of Groundwater Monitoring Wells in the 100-IU2/IU6 Groundwater Operable Unit

Groundwater Wells			
699-10-30B	699-41-11	699-53-35	699-64-62
699-11-45A	699-41-1A	699-54-15A	699-65-22
699-1-18	699-41-25	699-54-18A	699-65-23
699-13-26	699-41-4	699-54-19	699-65-38
699-14-47	699-42-12A	699-54-37A	699-65-50
699-15-26	699-42-2	699-54-42	699-65-59A
699-17-25A	699-42-21	699-54-45A	699-65-72
699-17-5	699-43-18	699-55-21	699-66-23
699-18-21	699-43-3	699-55-40	699-66-38
699-18-25A	699-43-88	699-55-44	699-66-39
699-19-23	699-43-89	699-55-76	699-66-58
699-20-20	699-43-9	699-55-89	699-66-64
699-20-E5A	699-44-16	699-56-40C	699-66-91
699-21-17	699-44-4	699-56-41	699-67-51
699-21-6	699-44-7	699-56-42A	699-69-38
699-25-20	699-45-2	699-57-25A	699-70-23
699-26-15A	699-46-31	699-57-29A	699-70-68
699-27-8	699-46-32	699-57-42	699-71-30
699-29-4	699-46-33	699-58-24	699-71-52
699-30-16	699-46-4	699-58-48	699-72-92
699-31-11	699-46-5	699-59-32	699-74-44
699-31-17	699-47-35A	699-60-32	699-74-48
699-31-8	699-47-5	699-60-57	699-77-44
699-32-18	699-48-18	699-60-59	699-77-54
699-32-22A	699-48-22	699-61-37	699-81-38
699-33-14	699-48-35	699-61-41	699-8-17
699-35-16	699-48-7A	699-61-55A	699-82-45A
699-35-19B	699-48-96	699-61-57	699-8-25
699-35-6	699-49-100A	699-61-62	699-8-32
699-35-9	699-49-13E	699-61-66	699-82-32
699-36-17	699-49-21	699-62-31	699-83-47
699-37-E1	699-49-28	699-62-43F	699-85-40A
699-37-E4	699-49-31	699-63-25A	699-86-42
699-38-15	699-49-32B	699-63-51	699-87-42A
699-38-19	699-49-33	699-63-55	699-88-41
699-39-23	699-50-28B	699-63-58	699-89-35
699-40-1	699-50-30	699-63-90	699-90-34
699-40-12C	699-51-19	699-63-92	699-S16-24
699-40-13	699-51-36A	699-63-95	699-S2-34A
699-40-20	699-52-17	699-64-27	699-S3-25
699-41-10	699-52-19		

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Table D1-3. Summary of Groundwater Analytes that Meet Exclusion Criteria for the 100-IU2/IU6 Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detections	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	Basis for Exclusion
Potassium-40	RAD	7/20/1992	6/23/2008	129	11	8.53%	pCi/L	-1.80E+02	300	21	268	Background Radiation
Radium-226	RAD	7/20/1992	10/24/2001	25	1	4.00%	pCi/L	-5.10E+01	200	33	33	Background Radiation
Thorium-228	RAD	7/20/1992	10/24/2001	25	2	8.00%	pCi/L	2.4	40	21	31	Background Radiation
Thorium-232	RAD	7/20/1992	10/24/2001	24	0	0.00%	pCi/L	30	67	--	--	Background Radiation
Calcium	METAL	1/21/1992	12/2/2008	143	143	100.00%	ug/L	--	--	15,900	96,000	Essential Nutrient
Magnesium	METAL	1/21/1992	12/2/2008	143	143	100.00%	ug/L	--	--	4,610	26,300	Essential Nutrient
Potassium	METAL	1/21/1992	12/2/2008	143	143	100.00%	ug/L	5,250	6,570	1,400	9,610	Essential Nutrient
Sodium	METAL	1/21/1992	12/2/2008	143	143	100.00%	ug/L	--	--	7,850	56,900	Essential Nutrient
Antimony-125	RAD	1/21/1992	6/23/2008	143	27	18.88%	pCi/L	-3.20E+01	6.9	0.53	24	Half-Life less than 3 years
Barium-140	RAD	7/22/1992	6/18/1993	3	0	0.00%	pCi/L	-1.90E+00	50	--	--	Half-Life less than 3 years
Beryllium-7	RAD	7/22/1992	6/23/2008	110	0	0.00%	pCi/L	-5.33E+01	100	--	--	Half-Life less than 3 years
Cerium-141	RAD	7/22/1992	6/18/1993	3	0	0.00%	pCi/L	-7.50E+00	20	--	--	Half-Life less than 3 years
Cerium-144	RAD	7/22/1992	6/18/1993	6	0	0.00%	pCi/L	0.46	60	--	--	Half-Life less than 3 years
Cesium-134	RAD	7/20/1992	6/23/2008	131	0	0.00%	pCi/L	-6.96E+00	20	--	--	Half-Life less than 3 years
Chromium-51	RAD	7/20/1992	4/28/1993	22	0	0.00%	pCi/L	100	900	--	--	Half-Life less than 3 years
Cobalt-58	RAD	7/22/1992	10/24/2001	10	0	0.00%	pCi/L	-3.30E+00	10	--	--	Half-Life less than 3 years
Iodine-131	RAD	7/22/1992	6/18/1993	3	0	0.00%	pCi/L	-3.50E+00	200	--	--	Half-Life less than 3 years
Iron-59	RAD	7/20/1992	10/24/2001	30	0	0.00%	pCi/L	-1.20E+01	100	--	--	Half-Life less than 3 years
Manganese-54	RAD	7/22/1992	6/18/1993	3	0	0.00%	pCi/L	1.6	8.0	--	--	Half-Life less than 3 years
Ruthenium-103	RAD	7/22/1992	6/18/1993	5	0	0.00%	pCi/L	-1.00E+00	20	--	--	Half-Life less than 3 years
Ruthenium-106	RAD	1/21/1992	6/23/2008	171	28	16.37%	pCi/L	-7.11E+01	200	2.7	65	Half-Life less than 3 years
Tin-113	RAD	4/27/1993	4/28/1993	3	0	0.00%	pCi/L	10	20	--	--	Half-Life less than 3 years
Zinc-65	RAD	7/20/1992	6/18/1993	23	0	0.00%	pCi/L	-3.70E+00	40	--	--	Half-Life less than 3 years
Zirconium-95	RAD	7/22/1992	6/18/1993	3	0	0.00%	pCi/L	-1.70E+00	10	--	--	Half-Life less than 3 years
Bismuth	METAL	4/22/1994	4/25/1995	3	0	0.00%	ug/L	10	126	--	--	No Toxicity Information
Delta-BHC	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0060	0.090	--	--	No Toxicity Information
Endrin ketone	PEST	7/20/1992	6/7/1994	22	0	0.00%	ug/L	0.10	0.10	--	--	No Toxicity Information
Selenium-79	RAD	11/3/2008	11/6/2008	3	0	0.00%	pCi/L	-5.85E+00	-1.42E-02	--	--	No action level
Thorium-234	RAD	7/22/1992	6/18/1993	3	0	0.00%	pCi/L	-6.00E+01	200	--	--	Half-Life less than 3 years
1,2,3-Trichlorobenzene	SVOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.50	1.0	--	--	No Toxicity Information
2,6-Dichlorophenol	SVOC	6/16/1992	6/16/1992	1	0	0.00%	ug/L	--	--	--	--	No Toxicity Information
2-Nitrophenol	SVOC	6/16/1992	11/6/2008	25	0	0.00%	ug/L	1.0	10	--	--	No Toxicity Information
3+4 Methylphenol (cresol, m+p)	SVOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	1.0	1.0	--	--	No Toxicity Information
4-Bromophenylphenyl ether	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	--	--	No Toxicity Information
4-Chlorophenylphenyl ether	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	--	--	No Toxicity Information
Benzothiazole	SVOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	1.0	1.0	--	--	No Toxicity Information
Bis(2-ethylhexyl) phthalate	SVOC	7/20/1992	11/6/2008	24	6	25.00%	ug/L	1.0	10.0	2	76	Common laboratory contaminant
Decane	SVOC	6/16/1992	6/16/1992	1	0	0.00%	ug/L	--	--	--	--	No Toxicity Information
Dodecane	SVOC	6/16/1992	6/16/1992	1	0	0.00%	ug/L	--	--	--	--	No Toxicity Information
Tetrachlorophenol	SVOC	6/16/1992	6/16/1992	1	0	0.00%	ug/L	--	--	--	--	No Toxicity Information
Tetradecane	SVOC	6/16/1992	6/16/1992	1	0	0.00%	ug/L	--	--	--	--	No Toxicity Information
Total cresols	SVOC	6/16/1992	6/16/1992	1	0	0.00%	ug/L	--	--	--	--	No Toxicity Information
Trichlorophenol	SVOC	6/16/1992	6/16/1992	1	0	0.00%	ug/L	--	--	--	--	No Toxicity Information
1,1-Dichloropropene	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.60	1.0	--	--	No Toxicity Information
2,2-Dichloropropane	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.60	1.0	--	--	No Toxicity Information
2-Picoline	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	1.0	1.0	--	--	No Toxicity Information
2-Propanol	VOC	11/10/1994	2/22/1995	4	0	0.00%	ug/L	500	500	--	--	No Toxicity Information
Acetone	VOC	3/12/1992	11/9/2008	94	18	19.15%	ug/L	0.21	100	0.25	27	Common laboratory contaminant
Bromochloromethane	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.70	1.0	--	--	No Toxicity Information
Ethyl cyanide	VOC	6/17/1997	11/9/2008	55	0	0.00%	ug/L	0.88	4.8	--	--	No Toxicity Information
Iodomethane	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	0.33	0.33	--	--	No Toxicity Information
Methylene chloride	VOC	1/21/1992	11/9/2008	155	13	8.39%	ug/L	0.08	14.00	0	5	Common laboratory contaminant

Table D1-3. Summary of Groundwater Analytes that Meet Exclusion Criteria for the 100-IU2/IU6 Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detections	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	Basis for Exclusion
n-Propylbenzene	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.40	1.0	--	--	No Toxicity Information
p-Cymene	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.40	1.0	--	--	No Toxicity Information
sec-Butylbenzene	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.50	1.0	--	--	No Toxicity Information
tert-Butylbenzene	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.40	1.0	--	--	No Toxicity Information
Tetrahydrofuran	VOC	3/12/1992	11/9/2008	50	0	0.00%	ug/L	1.2	10	--	--	No Toxicity Information
trans-1,4-Dichloro-2-butene	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	0.75	0.75	--	--	No Toxicity Information
Monopotassium phosphate	WATER QUALITY	10/25/1994	1/6/1995	2	1	50.00%	ug/L	1,000	1,000	40	40	No Toxicity Information
Silicon	METAL	4/22/1994	4/25/1995	3	3	100.00%	ug/L	--	--	16,900	19,900	No Toxicity Information
Uranium-235	RAD	7/20/1992	11/6/2008	37	7	18.92%	pCi/L	-1.91E-02	0.22	0.039	0.33	No action level
Ammonia	WATER QUALITY	7/20/1992	3/22/1994	26	9	34.62%	ug/L	50	100	70	7,520	No Toxicity Information
Phosphate	WATER QUALITY	1/21/1992	10/31/2007	380	10	2.63%	ug/L	22	1,000	51	2,330	No Toxicity Information
Uranium-234	RAD	1/12/1994	11/6/2008	14	14	100.00%	pCi/L	--	--	0.79	2.2	No action level
Nitrogen in Nitrite and Nitrate	WATER QUALITY	7/20/1992	4/22/1994	23	20	86.96%	ug/L	100	250	30	9,000	No Toxicity Information
Uranium-233/234	RAD	7/20/1992	1/6/1995	21	21	100.00%	pCi/L	--	--	0.27	1.3	No action level
Uranium-238	RAD	7/20/1992	11/6/2008	37	35	94.59%	pCi/L	9.5	9.5	0.24	1.9	No action level
Bromide	WATER QUALITY	1/21/1992	10/24/2001	332	77	23.19%	ug/L	11	1,250	19	52,000	No Toxicity Information
Gross beta	RAD	2/6/1992	11/6/2008	254	249	98.03%	pCi/L	-6.18E+00	18	2.7	240	4 mrem/yr
Alkalinity	WATER QUALITY	3/5/1992	12/2/2008	229	228	99.56%	ug/L			59,600	199,000	Water Quality
Chemical Oxygen Demand	WATER QUALITY	7/20/1992	6/18/1993	21	0	0.00%	ug/L	5,000	30,000	--	--	Water Quality
Coliform Bacteria	WATER QUALITY	4/30/1992	10/20/2005	9	2	22.22%	ug/L	0	1.0	2.0	1,200	Water Quality
Dissolved oxygen	WATER QUALITY	9/9/1993	11/6/2008	120	120	100.00%	ug/L	--	--	610	331,000	Water Quality
Oxidation Reduction Potential	WATER QUALITY	10/27/2000	11/4/2008	93	93	100.00%	ug/L	--	--	-1.98E+02	460	Water Quality
pH Measurement	WATER QUALITY	1/21/1992	2/10/2009	827	827	100.00%	ug/L	0.40	0.40	5.9	9.9	Water Quality
Specific Conductance	WATER QUALITY	1/21/1992	2/10/2009	826	826	100.00%	ug/L	--	--	152	1,426	Water Quality
Temperature	WATER QUALITY	1/21/1992	2/10/2009	817	817	100.00%	ug/L	--	--	9.1	26	Water Quality
Total dissolved solids	WATER QUALITY	7/20/1992	7/16/2003	46	46	100.00%	ug/L	--	--	165,000	324,000	Water Quality
Total Inorganic Carbon	WATER QUALITY	5/9/1994	6/2/1994	2	2	100.00%	ug/L	--	--	12,900	28,400	Water Quality
Total organic carbon	WATER QUALITY	4/30/1992	2/27/2007	120	74	61.67%	ug/L	0.50	1,000	0.83	24,000	Water Quality
Total organic halides	WATER QUALITY	2/6/1992	2/27/2007	87	25	28.74%	ug/L	2.2	20	2.9	27	Water Quality
Turbidity	WATER QUALITY	3/11/1992	2/10/2009	492	492	100.00%	ug/L	--	--	0	245	Water Quality
Sodium nitrite	WATER QUALITY	10/25/1994	10/25/1994	1	0	0.00%	ug/L	20	20	--	--	Water Quality

BHC = hexachlorocyclohexane
PEST = pesticides
RAD = radiological
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound

Table D1-4. Summary of Groundwater Analytes that Were Not Detected for the 100-IU2/IU6 Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Action Level	Action Level Basis	Level of Exceedence
Tin	METAL	1/21/1992	10/21/1999	15	0	0.00%	ug/L	2.6	2.6	9.60E+03	WAC 173-340-720(4)	2.71E-04
Aroclor-1016	PCB	7/20/1992	6/7/1994	22	0	0.00%	ug/L	0.5	1	6.40E-05	Human Health Water + Organism	7.81E+03
Aroclor-1221	PCB	7/20/1992	6/7/1994	22	0	0.00%	ug/L	0.5	2	6.40E-05	Human Health Water + Organism	7.81E+03
Aroclor-1232	PCB	7/20/1992	6/7/1994	22	0	0.00%	ug/L	0.5	1	6.40E-05	Human Health Water + Organism	7.81E+03
Aroclor-1242	PCB	7/20/1992	6/7/1994	22	0	0.00%	ug/L	0.5	1	6.40E-05	Human Health Water + Organism	7.81E+03
Aroclor-1248	PCB	7/20/1992	6/7/1994	22	0	0.00%	ug/L	0.65	1	6.40E-05	Human Health Water + Organism	1.02E+04
Aroclor-1254	PCB	7/20/1992	6/7/1994	22	0	0.00%	ug/L	1	1	6.40E-05	Human Health Water + Organism	1.56E+04
Aroclor-1260	PCB	7/20/1992	6/7/1994	22	0	0.00%	ug/L	1	1	6.40E-05	Human Health Water + Organism	1.56E+04
4,4'-DDD (Dichlorodiphenyldichloroethane)	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0038	0.11	3.10E-04	Human Health Water + Organism	1.23E+01
4,4'-DDE (Dichlorodiphenyldichloroethylene)	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0027	0.1	2.20E-04	Human Health Water + Organism	1.23E+01
4,4'-DDT (Dichlorodiphenyltrichloroethane)	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0056	0.12	2.20E-04	Human Health Water + Organism	2.55E+01
Aldrin	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.004	0.05	4.90E-05	Human Health Water + Organism	8.16E+01
Alpha-BHC	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0025	0.05	2.60E-03	Human Health Water + Organism	9.62E-01
Alpha-Chlordane	PEST	7/20/1992	6/8/1993	21	0	0.00%	ug/L	0.05	0.14	8.00E-04	Human Health Water + Organism	6.25E+01
beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.013	0.06	9.10E-03	Human Health Water + Organism	1.43E+00
Chlordane	PEST	6/7/1994	11/6/2008	4	0	0.00%	ug/L	0.14	0.18	8.00E-04	Human Health Water + Organism	1.75E+02
Dieldrin	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0023	0.1	5.20E-05	Human Health Water + Organism	4.42E+01
Dinoseb(2-secButyl-4,6-dinitrophenol)	PEST	6/16/1992	6/16/1992	1	0	0.00%	ug/L	--	--	7.00E+00	Federal MCL	--
Endosulfan I	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0025	0.14	5.60E-02	Freshwater CCC	4.46E-02
Endosulfan II	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.01	0.1	5.60E-02	Freshwater CCC	1.79E-01
Endosulfan sulfate	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.017	0.66	6.20E+01	Human Health Water + Organism	2.74E-04
Endrin	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0028	0.1	3.60E-02	Freshwater CCC	7.78E-02
Endrin aldehyde	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0032	0.23	2.90E-01	Human Health Water + Organism	1.10E-02
Gamma-BHC (Lindane)	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0025	0.05	3.84E-02	WAC 173-340-730(3)	6.51E-02
Heptachlor	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0025	0.05	7.90E-05	Human Health Water + Organism	3.16E+01
Heptachlor epoxide	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.0032	0.83	3.90E-05	Human Health Water + Organism	8.21E+01
Methoxychlor	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.005	1.8	3.00E-02	Freshwater CCC	1.67E-01
Toxaphene	PEST	7/20/1992	11/6/2008	25	0	0.00%	ug/L	0.33	5	2.00E-04	Freshwater CCC	1.65E+03
trans-Chlordane	PEST	7/20/1992	6/8/1993	21	0	0.00%	ug/L	0.05	0.14	8.00E-04	Human Health Water + Organism	6.25E+01
Europium-152	RAD	7/20/1992	6/23/2008	92	0	0.00%	pCi/L	-20	50	2.00E+02	Federal MCL	-1.00E-01
Europium-154	RAD	7/20/1992	6/23/2008	140	0	0.00%	pCi/L	-16.1	30	6.00E+01	Federal MCL	-2.68E-01
Europium-155	RAD	7/22/1992	6/23/2008	120	0	0.00%	pCi/L	-64	30	6.00E+02	Federal MCL	-1.07E-01
Neptunium-237	RAD	11/3/2008	11/6/2008	3	0	0.00%	pCi/L	-0.00808	0	1.50E+01	Federal MCL	-5.39E-04
Plutonium-238	RAD	7/20/1992	2/27/2007	33	0	0.00%	pCi/L	-0.0309	0.06	1.50E+01	Federal MCL	-2.06E-03
Plutonium-239	RAD	7/22/1992	6/18/1993	3	0	0.00%	ug/L	0.0044	0.013	1.50E+01	Federal MCL	2.93E-04
Plutonium-239/240	RAD	7/20/1992	2/27/2007	33	0	0.00%	pCi/L	-0.139	0.129	1.50E+01	Federal MCL	-9.27E-03
Protactinium-231	RAD	11/3/2008	11/6/2008	3	0	0.00%	pCi/L	0	0.029	1.50E+01	Federal MCL	0.00E+00
Radium-228	RAD	10/21/1999	10/24/2001	2	0	0.00%	pCi/L	--	--	5.00E+00	Federal MCL	--
2,4-Dinitrophenol	SVOC	6/16/1992	11/6/2008	25	0	0.00%	ug/L	2	26	3.20E+01	WAC 173-340-720(4)	6.25E-02
1,2,4-Trichlorobenzene	SVOC	7/20/1992	6/7/1994	24	0	0.00%	ug/L	0.5	10	3.50E+01	Human Health Water + Organism	1.43E-02
1,2,4-Trimethylbenzene	SVOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.4	1	8.00E+02	WAC 173-340-720(4)	5.00E-04
1,3,5-Trimethylbenzene	SVOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.4	1	1.20E+01	Regionsl Screening Values	3.33E-02
2,4,5-Trichlorophenol	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	25	26	8.00E+02	WAC 173-340-720(4)	3.13E-02
2,4,6-Trichlorophenol	SVOC	6/16/1992	6/18/1993	22	0	0.00%	ug/L	10	10	1.40E+00	Human Health Water + Organism	7.14E+00
2,4-Dichlorophenol	SVOC	6/16/1992	11/6/2008	25	0	0.00%	ug/L	1	10	4.80E+01	WAC 173-340-720(4)	2.08E-02
2,4-Dimethylphenol	SVOC	6/16/1992	6/18/1993	22	0	0.00%	ug/L	10	10	3.20E+02	WAC 173-340-720(4)	3.13E-02
2,4-Dinitrotoluene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	1.10E-01	Human Health Water + Organism	9.09E+01
2,6-Dinitrotoluene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	1.60E+01	WAC 173-340-720(4)	6.25E-01
2-Chloronaphthalene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	1.00E+03	Human Health Water + Organism	1.00E-02
2-Chlorophenol	SVOC	6/16/1992	6/18/1993	22	0	0.00%	ug/L	10	10	4.00E+01	WAC 173-340-720(4)	2.50E-01
2-Methylnaphthalene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.20E+01	WAC 173-340-720(4)	3.13E-01
2-Methylphenol (cresol, o-)	SVOC	6/16/1992	11/6/2008	25	0	0.00%	ug/L	2	10	4.00E+02	WAC 173-340-720(4)	5.00E-03
2-Nitroaniline	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	25	26	2.40E+01	WAC 173-340-720(4)	1.04E+00
3,3'-Dichlorobenzidine	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	2.10E-02	Human Health Water + Organism	4.76E+02

Table D1-4. Summary of Groundwater Analytes that Were Not Detected for the 100-IU2/IU6 Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Action Level	Action Level Basis	Level of Exceedence
3-Methylphenol (cresol, m-)	SVOC	6/16/1992	6/16/1992	1	0	0.00%	ug/L	--	--	4.00E+02	WAC 173-340-720(4)	--
3-Nitroaniline	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	25	26	2.08E+00	WAC 173-340-720(4)	1.20E+01
4,6-Dinitro-2-methylphenol	SVOC	6/16/1992	6/18/1993	22	0	0.00%	ug/L	25	26	1.60E+00	WAC 173-340-720(4)	1.56E+01
4-Chloro-3-methylphenol	SVOC	6/16/1992	6/18/1993	22	0	0.00%	ug/L	10	10	8.00E+02	WAC 173-340-720(4)	1.25E-02
4-Chloroaniline	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	6.40E+01	WAC 173-340-720(4)	1.56E-01
4-Methylphenol (cresol, p-)	SVOC	6/16/1992	6/18/1993	22	0	0.00%	ug/L	10	10	4.00E+01	WAC 173-340-720(4)	2.50E-01
4-Nitroaniline	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	25	26	2.08E+00	WAC 173-340-720(4)	1.20E+01
4-Nitrophenol	SVOC	6/16/1992	6/18/1993	22	0	0.00%	ug/L	25	26	1.28E+02	WAC 173-340-720(4)	1.95E-01
Acenaphthene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	6.43E+02	WAC 173-340-730(3)	1.56E-02
Acenaphthylene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	6.43E+02	WAC 173-340-730(3)	1.56E-02
Anthracene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	2.40E+03	WAC 173-340-720(4)	4.17E-03
Benzo(a)anthracene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.80E-03	Human Health Water + Organism	2.63E+03
Benzo(a)pyrene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.80E-03	Human Health Water + Organism	2.63E+03
Benzo(b)fluoranthene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.80E-03	Human Health Water + Organism	2.63E+03
Benzo(ghi)perylene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	4.80E+02	WAC 173-340-720(4)	2.08E-02
Benzo(k)fluoranthene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.80E-03	Human Health Water + Organism	2.63E+03
Bis(2-chloro-1-methylethyl)ether	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	1.25E+00	WAC 173-340-720(4)	8.00E+00
Bis(2-Chloroethoxy)methane	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.98E-02	WAC 173-340-720(4)	2.51E+02
Bis(2-chloroethyl) ether	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.00E-02	Human Health Water + Organism	3.33E+02
Butylbenzylphthalate	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	1.25E+03	WAC 173-340-730(3)	8.00E-03
Carbazole	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	4.38E+00	WAC 173-340-720(4)	2.28E+00
Chrysene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.80E-03	Human Health Water + Organism	2.63E+03
Dibenz[a,h]anthracene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.80E-03	Human Health Water + Organism	2.63E+03
Dibenzofuran	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.20E+01	WAC 173-340-720(4)	3.13E-01
Diethylphthalate	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	1.28E+04	WAC 173-340-720(4)	7.81E-04
Dimethoate	SVOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	1.1	1.1	3.20E+00	WAC 173-340-720(4)	3.44E-01
Dimethyl phthalate	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	1.60E+04	WAC 173-340-720(4)	6.25E-04
Di-n-octylphthalate	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.20E+02	WAC 173-340-720(4)	3.13E-02
Fluoranthene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	9.02E+01	WAC 173-340-730(3)	1.11E-01
Fluorene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	6.40E+02	WAC 173-340-720(4)	1.56E-02
Hexachlorobenzene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	2.80E-04	Human Health Water + Organism	3.57E+04
Hexachlorobutadiene	SVOC	7/20/1992	6/7/1994	24	0	0.00%	ug/L	0.6	10	4.40E-01	Human Health Water + Organism	1.36E+00
Hexachlorocyclopentadiene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	4.00E+01	Human Health Water + Organism	2.50E-01
Hexachloroethane	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	1.40E+00	Human Health Water + Organism	7.14E+00
Indeno(1,2,3-cd)pyrene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.80E-03	Human Health Water + Organism	2.63E+03
Naphthalene	SVOC	6/16/1992	11/6/2008	28	0	0.00%	ug/L	0.7	10	1.60E+02	WAC 173-340-720(4)	4.38E-03
Nitrobenzene	SVOC	7/20/1992	11/6/2008	24	0	0.00%	ug/L	1	10	1.60E+01	WAC 173-340-720(4)	6.25E-02
n-Nitrosodi-n-dipropylamine	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	5.00E-03	Human Health Water + Organism	2.00E+03
n-Nitrosodiphenylamine	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.30E+00	Human Health Water + Organism	3.03E+00
Pentachlorophenol	SVOC	6/16/1992	11/6/2008	25	0	0.00%	ug/L	2	26	2.70E-01	Human Health Water + Organism	7.41E+00
Phenanthrene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	2.40E+03	WAC 173-340-720(4)	4.17E-03
Phenol	SVOC	6/16/1992	11/6/2008	25	0	0.00%	ug/L	4	10	4.80E+03	WAC 173-340-720(4)	8.33E-04
Pyrene	SVOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	4.80E+02	WAC 173-340-720(4)	2.08E-02
Tributyl phosphate	SVOC	6/16/1992	11/6/2008	4	0	0.00%	ug/L	1.5	1.5	1.62E+01	WAC 173-340-720(4)	9.26E-02
Tris-2-chloroethyl phosphate	SVOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	1	1	4.80E+00	Regional Screening Values	2.08E-01
Total petroleum hydrocarbons - diesel range	TPH	12/20/1993	12/20/1993	1	0	0.00%	ug/L	2000	2000	5.00E+02	WAC 173-340-720(3)	4.00E+00
(m+p)-Xylene	VOC	11/30/1993	3/22/1994	2	0	0.00%	ug/L	1	1	1.60E+03	WAC 173-340-720(4)	6.25E-04
1,1,1,2-Tetrachloroethane	VOC	11/30/1993	11/6/2008	6	0	0.00%	ug/L	0.1	1	1.68E+00	WAC 173-340-720(4)	5.95E-02
1,1,2,2-Tetrachloroethane	VOC	7/20/1992	11/6/2008	38	0	0.00%	ug/L	0.27	10	1.70E-01	Human Health Water + Organism	1.59E+00
1,1-Dichloroethene	VOC	7/20/1992	11/9/2008	56	0	0.00%	ug/L	0.04	10	7.29E-02	WAC 173-340-720(4)	5.49E-01
1,2,3-Trichloropropane	VOC	11/30/1993	11/6/2008	6	0	0.00%	ug/L	0.22	1	6.25E-03	WAC 173-340-720(4)	3.52E+01
1,2-Dibromo-3-chloropropane	VOC	11/30/1993	11/6/2008	6	0	0.00%	ug/L	0.48	1	3.13E-02	WAC 173-340-720(4)	1.53E+01
1,2-Dibromoethane	VOC	11/30/1993	11/6/2008	6	0	0.00%	ug/L	0.15	1	4.38E-02	WAC 173-340-720(4)	3.42E+00
1,2-Dichlorobenzene	VOC	7/20/1992	6/7/1994	25	0	0.00%	ug/L	0.5	10	4.20E+02	Human Health Water + Organism	1.19E-03

Table D1-4. Summary of Groundwater Analytes that Were Not Detected for the 100-IU2/IU6 Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Action Level	Action Level Basis	Level of Exceedence
1,2-Dichloroethene (Total)	VOC	3/12/1992	11/6/2008	34	0	0.00%	ug/L	0.14	10	7.20E+01	WAC 173-340-720(4)	1.94E-03
1,2-Dichloropropane	VOC	7/20/1992	11/6/2008	38	0	0.00%	ug/L	0.077	10	5.00E-01	Human Health Water + Organism	1.54E-01
1,3-Dichlorobenzene	VOC	7/20/1992	6/7/1994	25	0	0.00%	ug/L	0.5	10	2.40E+02	WAC 173-340-720(4)	2.08E-03
1,3-Dichloropropane	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.3	1	7.30E+02	Regional Screening Values	4.11E-04
1,4-Dioxane	VOC	1/14/2003	11/6/2008	19	0	0.00%	ug/L	2.6	12	3.98E+00	WAC 173-340-720(4)	6.53E-01
1-Butanol	VOC	3/12/1992	11/9/2008	56	0	0.00%	ug/L	1.1	1000	8.00E+02	WAC 173-340-720(4)	1.38E-03
2-Butanone	VOC	3/12/1992	11/9/2008	94	0	0.00%	ug/L	0.1	100	4.80E+03	WAC 173-340-720(4)	2.08E-05
2-Chlorotoluene	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.4	1	1.60E+02	WAC 173-340-720(4)	2.50E-03
2-Hexanone	VOC	7/20/1992	11/6/2008	35	0	0.00%	ug/L	0.08	10	6.40E+02	WAC 173-340-720(4)	1.25E-04
2-Pentanone, 4-Methyl	VOC	3/12/1992	11/9/2008	92	0	0.00%	ug/L	0.1	50	6.40E+02	WAC 173-340-720(4)	1.56E-04
4-Chlorotoluene	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.4	1	2.60E+03	Regional Screening Values	1.54E-04
Acetonitrile	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	4.2	4.2	1.30E+02	Regional Screening Values	3.23E-02
Acrolein	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	0.52	0.52	4.00E+00	WAC 173-340-720(4)	1.30E-01
Allyl chloride	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	0.2	0.2	8.00E+02	WAC 173-340-720(4)	2.50E-04
Bromobenzene	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.5	1	2.00E+01	Regional Screening Values	2.50E-02
Bromodichloromethane	VOC	7/20/1992	11/6/2008	42	0	0.00%	ug/L	0.088	10	5.50E-01	Human Health Water + Organism	1.60E-01
Bromoform	VOC	7/20/1992	11/6/2008	42	0	0.00%	ug/L	0.27	10	4.30E+00	Human Health Water + Organism	6.28E-02
Bromomethane	VOC	7/20/1992	11/6/2008	38	0	0.00%	ug/L	0.5	10	1.12E+01	WAC 173-340-720(4)	4.46E-02
Carbon disulfide	VOC	7/20/1992	11/9/2008	87	0	0.00%	ug/L	0.029	10	8.00E+02	WAC 173-340-720(4)	3.63E-05
Chlorobenzene	VOC	7/20/1992	11/9/2008	43	0	0.00%	ug/L	0.4	10	1.30E+02	Human Health Water + Organism	3.08E-03
Chloroethane	VOC	7/20/1992	11/6/2008	38	0	0.00%	ug/L	0.085	10	2.10E+04	Regional Screening Values	4.05E-06
Chloroprene	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	0.085	0.085	3.20E+02	WAC 173-340-720(4)	2.66E-04
cis-1,3-Dichloropropene	VOC	7/20/1992	11/6/2008	38	0	0.00%	ug/L	0.099	10	2.43E-01	WAC 173-340-720(4)	4.07E-01
Dibromochloromethane	VOC	7/20/1992	11/6/2008	42	0	0.00%	ug/L	0.17	10	4.00E-01	Human Health Water + Organism	4.25E-01
Dibromomethane	VOC	11/30/1993	11/6/2008	6	0	0.00%	ug/L	0.14	1	8.00E+01	WAC 173-340-720(4)	1.75E-03
Dichlorodifluoromethane	VOC	11/30/1993	11/6/2008	6	0	0.00%	ug/L	0.074	1	1.60E+03	WAC 173-340-720(4)	4.63E-05
Ethyl methacrylate	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	0.39	0.39	7.20E+02	WAC 173-340-720(4)	5.42E-04
Hexane	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	0.16	0.16	4.80E+02	WAC 173-340-720(4)	3.33E-04
Isobutyl alcohol	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	6.1	6.1	2.40E+03	WAC 173-340-720(4)	2.54E-03
Isophorone	VOC	7/20/1992	6/18/1993	21	0	0.00%	ug/L	10	10	3.50E+01	Human Health Water + Organism	2.86E-01
Isopropylbenzene	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.3	1	1.60E+03	WAC 173-340-720(4)	1.88E-04
Methacrylonitrile	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	1.8	1.8	8.00E-01	WAC 173-340-720(4)	2.25E+00
Methyl methacrylate	VOC	11/3/2008	11/6/2008	3	0	0.00%	ug/L	0.62	0.62	1.12E+04	WAC 173-340-720(4)	5.54E-05
m-Xylene	VOC	3/16/1993	6/7/1994	2	0	0.00%	ug/L	0.8	10	1.60E+03	WAC 173-340-720(4)	5.00E-04
n-Butylbenzene	VOC	11/30/1993	6/7/1994	3	0	0.00%	ug/L	0.5	1	3.20E+02	WAC 173-340-720(4)	1.56E-03
o-Xylene	VOC	9/16/1992	6/7/1994	4	0	0.00%	ug/L	0.4	1	1.60E+03	WAC 173-340-720(4)	2.50E-04
p-Xylene	VOC	3/16/1993	3/16/1993	1	0	0.00%	ug/L	10	10	1.50E+03	Regional Screening Values	6.67E-03
Styrene	VOC	7/20/1992	11/6/2008	38	0	0.00%	ug/L	0.079	10	1.46E+00	WAC 173-340-720(4)	5.41E-02
trans-1,3-Dichloropropene	VOC	7/20/1992	11/6/2008	38	0	0.00%	ug/L	0.08	10	2.43E-01	WAC 173-340-720(4)	3.29E-01
Trichloromonofluoromethane	VOC	9/16/1992	11/6/2008	7	0	0.00%	ug/L	0.1	1	2.40E+03	WAC 173-340-720(4)	4.17E-05
Vinyl acetate	VOC	7/22/1992	11/6/2008	8	0	0.00%	ug/L	0.22	10	8.00E+03	WAC 173-340-720(4)	2.75E-05
Vinyl chloride	VOC	3/5/1992	11/9/2008	115	0	0.00%	ug/L	0.044	10	2.50E-02	Human Health Water + Organism	1.76E+00
Hydrazine	WET CHEM	9/22/1992	6/18/1993	9	0	0.00%	ug/L	3	3	1.46E-02	WAC 173-340-720(4)	2.05E+02
Perchlorate anion	WET CHEM	3/23/1995	3/23/1995	1	0	0.00%	ug/L	500	500	2.60E+01	Regional Screening Values	1.92E+01
Sulfide	WET CHEM	7/20/1992	6/18/1993	18	0	0.00%	ug/L	100	1000	2.00E+00	Freshwater CCC	5.00E+01

WAC 173-340-720(3), "Method A Cleanup Levels for Potable Ground Water."
WAC 173-340-720(4), "Method B Cleanup Levels for Potable Ground Water."
WAC 173-340-730(3), "Method B Surface Water Cleanup Levels."
BHC = hexachlorocyclohexane
CCC = criteria continuous concentration
MCL = maximum contaminant level
PCB = polychlorinated biphenyls
PEST = pesticides
RAD = radiological
SVOC = Semivolatile Organic Compound
TPH = total petroleum hydrocarbon(s)
VOC = Volatile Organic Compound
WAC = Washington Administrative Code
WET CHEM = wet chemistry

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Table D1-5. Summary of Groundwater Analytes that Do Not Exceed an Action Level for the 100-IU2/IU6 Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	Action Level	Action Level Basis	Level of Exceedence	COPC?	Basis For Exclusion
Barium	METAL	1/21/1992	12/2/2008	142	140	98.59%	ug/L	13.1	17.9	8.8	338	1.00E+03	Human Health Water + Organism	3.38E-01	No	Max concentration and MDLs < action level
Beryllium	METAL	1/21/1992	12/2/2008	137	12	8.76%	ug/L	0.053	4	0.32	2	4.00E+00	Federal MCL	5.00E-01	No	Max concentration and MDLs < action level
Chromium	METAL	1/21/1992	12/2/2008	142	69	48.59%	ug/L	2.1	13	2.3	51.8	7.40E+01	Freshwater CCC	7.00E-01	No	Max concentration and MDLs < action level
Selenium	METAL	7/21/1992	10/20/1995	42	13	30.95%	ug/L	0.7	16.5	1.1	4.6	5.00E+00	Freshwater CCC	9.20E-01	No	Max concentration < action level
Silver	METAL	1/21/1992	12/2/2008	137	5	3.65%	ug/L	0.6	10	4.9	11.1	8.00E+01	WAC 173-340-720(4)	1.39E-01	No	Max concentration and MDLs < action level
Strontium	METAL	4/17/1997	12/2/2008	63	63	100.00%	ug/L			124	768	9.60E+03	WAC 173-340-720(4)	8.00E-02	No	Max concentration and MDLs < action level
Uranium	METAL	2/19/1992	11/6/2008	28	28	100.00%	ug/L			0.195	6.18	3.00E+01	Federal MCL	2.06E-01	No	Max concentration and MDLs < action level
Vanadium	METAL	1/21/1992	12/2/2008	135	110	81.48%	ug/L	3.6	35.3	3.4	41.6	1.12E+02	WAC 173-340-720(4)	3.71E-01	No	Max concentration and MDLs < action level
Americium-241	RAD	7/20/1992	10/24/2001	23	2	8.70%	pCi/L	-0.015	0.055	0.08	0.89	1.50E+01	Federal MCL	5.93E-02	Yes	Insufficient analytical results
Carbon-14	RAD	7/20/1992	1/19/1996	50	3	6.00%	pCi/L	-130	50	46	240	2.00E+03	Federal MCL	1.20E-01	Yes	Insufficient analytical results
Cesium-137	RAD	1/21/1992	6/23/2008	189	32	16.93%	pCi/L	-12.8	20	0.182999998	7.5	2.00E+02	Federal MCL	3.75E-02	Yes	Insufficient analytical results
Cobalt-60	RAD	1/21/1992	6/23/2008	189	35	18.52%	pCi/L	-9.760000229	30	0.141	10.19999981	1.00E+02	Federal MCL	1.02E-01	Yes	Insufficient analytical results
Technetium-99	RAD	1/21/1992	11/6/2008	239	195	81.59%	pCi/L	-7.87	5.7	0.279	260	9.00E+02	Federal MCL	2.89E-01	Yes	Insufficient analytical results
1,4-Dichlorobenzene	SVOC	3/5/1992	11/9/2008	105	3	2.86%	ug/L	0.047	10	0.075	0.46	1.82E+00	WAC 173-340-720(4)	2.53E-01	No	MDLs > action level; not identifed as a vadose zone target analyte
Di-n-butylphthalate	SVOC	7/20/1992	6/18/1993	21	2	9.52%	ug/L	10	10	0.6	2	1.60E+03	WAC 173-340-720(4)	1.25E-03	No	Max concentration and MDLs < action level
Chloroform	VOC	1/21/1992	11/9/2008	155	14	9.03%	ug/L	0.029	10	0.056	0.67	5.70E+00	Human Health Water + Organism	1.18E-01	Yes	Some MDLs > action level; identified as a vadose zone target analyte
1,1,1-Trichloroethane	VOC	1/21/1992	11/9/2008	155	2	1.29%	ug/L	0.035	10	0.16	0.29	2.00E+02	Federal MCL	1.45E-03	No	Max concentration and MDLs < action level
1,1,2-Trichloroethane	VOC	3/5/1992	11/9/2008	115	3	2.61%	ug/L	0.047	10	0.067	0.14	5.90E-01	Human Health Water + Organism	2.37E-01	No	MDLs > action level; not identifed as a vadose zone target analyte
1,1-Dichloroethane	VOC	1/21/1992	11/9/2008	155	2	1.29%	ug/L	0.046	10	0.15	0.29	5.50E-01	Human Health Water + Organism	5.27E-01	No	MDLs > action level; not identifed as a vadose zone target analyte
1,2-Dichloroethane	VOC	1/21/1992	11/9/2008	155	1	0.65%	ug/L	0.049	10	0.13	0.13	3.80E-01	Human Health Water + Organism	3.42E-01	No	MDLs > action level; not identifed as a vadose zone target analyte
Chloromethane	VOC	7/20/1992	11/6/2008	38	1	2.63%	ug/L	0.036	10	0.82	0.82	3.37E+00	WAC 173-340-720(4)	2.43E-01	No	MDLs > action level; not identifed as a vadose zone target analyte
cis-1,2-Dichloroethylene	VOC	1/21/1992	11/9/2008	123	1	0.81%	ug/L	0.048	1	0.21	0.21	7.00E+01	Federal MCL	3.00E-03	No	Max concentration and MDLs < action level
Ethylbenzene	VOC	1/21/1992	11/9/2008	127	3	2.36%	ug/L	0.034	10	0.064	0.13	5.30E+02	Human Health Water + Organism	2.45E-04	No	Max concentration and MDLs < action level
Toluene	VOC	1/21/1992	11/9/2008	155	5	3.23%	ug/L	0.025	10	0.12	18	6.40E+02	WAC 173-340-720(4)	2.81E-02	No	Max concentration and MDLs < action level
trans-1,2-Dichloroethylene	VOC	1/21/1992	11/9/2008	124	2	1.61%	ug/L	0.016	10	0.18	0.3	1.00E+02	Federal MCL	3.00E-03	No	Max concentration and MDLs < action level
Xylenes (total)	VOC	1/21/1992	11/9/2008	151	2	1.32%	ug/L	0.085	10	0.19	0.27	1.60E+03	WAC 173-340-720(4)	1.69E-04	No	Max concentration and MDLs < action level
Chloride	WET CHEM	1/21/1992	12/2/2008	670	670	100.00%	ug/L			1200	56700	2.30E+05	Freshwater CCC	2.47E-01	No	Max concentration and MDLs < action level
Sulfate	WET CHEM	1/21/1992	12/2/2008	690	688	99.71%	ug/L	20200	20200	200	180000	2.50E+05	Federal MCL	7.20E-01	No	Max concentration and MDLs < action level

WAC 173-340-720(4), "Method Cleanup Levels for Potable Ground Water."
CCC = criteria continuous concentration
MCL = maximum contaminant level
PCB = polychlorinated biphenyls
PEST = pesticides
RAD = radiological
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound
WAC = Washington Administrative Code
WET CHEM = wet chemistry

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Table D1-6. Summary of Groundwater Analytes that Exceed an Action Level for the 100-IU2/IU6 Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	Action Level	Action Level Basis	Level of Exceedence	COPC?	Basis For Inclusion
Aluminum	METAL	7/20/1992	10/21/2005	107	33	30.84%	ug/L	10.6	125	13.6	1740	5.00E+01	Federal MCL	3.48E+01	No	Naturally occurring; not identified as a vadose zone target analyte
Antimony	METAL	1/21/1992	12/2/2008	137	11	8.03%	ug/L	1	60	2.6	57.6	5.60E+00	Human Health Water + Organism	1.03E+01	Yes	Max concentration and MDLs > action level
Arsenic	METAL	7/20/1992	11/6/2008	56	39	69.64%	ug/L	1.8	6.9	1.5	10.9	1.80E-02	Human Health Water + Organism	6.06E+02	Yes	Max concentration and MDLs > action level
Cadmium	METAL	1/21/1992	12/2/2008	142	4	2.82%	ug/L	0.058	7	1.5	2.4	2.50E-01	Federal MCL	9.60E+00	Yes	Max concentration and MDLs > action level
Cobalt	METAL	1/21/1992	12/2/2008	135	5	3.70%	ug/L	0.7	29	1.6	14.2	4.80E+00	WAC 173-340-720(4)	2.96E+00	Yes	Max concentration and MDLs > action level
Copper	METAL	1/21/1992	12/2/2008	137	27	19.71%	ug/L	0.5	68.7	2	423	9.00E+00	Freshwater CCC	4.70E+01	Yes	Max concentration and MDLs > action level
Hexavalent Chromium	METAL	1/3/2008	12/1/2008	6	4	66.67%	ug/L	2	2	8.1	11	1.00E+01	Freshwater CCC	1.10E+00	Yes	Max concentration > action level
Iron	METAL	1/21/1992	12/2/2008	143	117	81.82%	ug/L	3.7	110	9.8	42100	3.00E+02	Federal MCL	1.40E+02	No	Naturally occurring; not identified as a vadose zone target analyte
Lead	METAL	7/20/1992	11/6/2008	86	41	47.67%	ug/L	0.1	4.3	0.1	46.1	2.50E+00	Freshwater CCC	1.84E+01	Yes	Max concentration and MDLs > action level
Manganese	METAL	1/21/1992	12/2/2008	144	85	59.03%	ug/L	0.8	26.5	1	1100	5.00E+01	Federal MCL	2.20E+01	Yes	Max concentration > action level
Mercury	METAL	7/20/1992	7/16/2003	76	2	2.63%	ug/L	0.1	0.2	0.11	0.25	1.20E-02	WAC 173-201A	2.08E+01	Yes	Max concentration and MDLs > action level
Nickel	METAL	1/21/1992	12/2/2008	137	8	5.84%	ug/L	0.97	37.5	2.1	77.7	5.20E+01	Freshwater CCC	1.49E+00	Yes	Max concentration > action level
Thallium	METAL	7/20/1992	11/6/2008	53	1	1.89%	ug/L	0.05	11	1	1	2.40E-01	Human Health Water + Organism	4.17E+00	Yes	Max concentration and MDLs > action level
Zinc	METAL	1/21/1992	12/2/2008	135	94	69.63%	ug/L	1.3	73.8	3	7780	1.20E+02	Freshwater CCC	6.48E+01	Yes	Max concentration > action level
Gross alpha	RAD	2/6/1992	11/25/2008	231	166	71.86%	pCi/L	-0.69	3	1	21	1.50E+01	Federal MCL	1.40E+00	No	Anomalous result; use as an indicator parameter to confirm current concentrations do not exceed MCL
Iodine-129	RAD	3/11/1992	11/6/2008	260	91	35.00%	pCi/L	-0.894	3.2	0.0202	7.86	1.00E+00	Federal MCL	7.86E+00	Yes	Max concentration and MDLs > action level
Strontium-90	RAD	2/20/1992	11/6/2008	166	10	6.02%	pCi/L	-1	1.6	0.0892	14.30000019	8.00E+00	Federal MCL	1.79E+00	Yes	Max concentration > action level
Tritium	RAD	1/21/1992	12/2/2008	742	599	80.73%	pCi/L	-232	410	0.961	283000	2.00E+04	Federal MCL	1.42E+01	Yes	Max concentration > action level
Benzene	VOC	1/21/1992	11/9/2008	155	3	1.94%	ug/L	0.032	10	2	5.2	7.95E-01	WAC 173-340-720(4)	6.54E+00	Yes	Max concentration and MDLs > action level
Carbon tetrachloride	VOC	1/21/1992	11/9/2008	155	7	4.52%	ug/L	0.039	10	0.2	33	2.30E-01	Human Health Water + Organism	1.43E+02	Yes	Max concentration and MDLs > action level
Tetrachloroethene	VOC	1/21/1992	11/9/2008	155	2	1.29%	ug/L	0.035	10	0.18	0.32	8.10E-02	WAC 173-340-720(4)	3.95E+00	Yes	Max concentration and MDLs > action level
Trichloroethene	VOC	1/21/1992	11/9/2008	154	25	16.23%	ug/L	0.037	17	0.1	25	4.92E-01	WAC 173-340-720(4)	5.08E+01	Yes	Max concentration and MDLs > action level
Cyanide	WET CHEM	2/20/1992	4/8/2008	58	8	13.79%	ug/L	0.95	20	1.7	5.9	5.20E+00	Freshwater CCC	1.13E+00	No	Anomolous results;
Fluoride	WET CHEM	1/21/1992	12/2/2008	692	685	98.99%	ug/L	20	500	21	3800	9.60E+02	WAC 173-340-720(4)	3.96E+00	Yes	Max concentration > action level
Nitrate (ASN)	WET CHEM	1/21/1992	12/2/2008	652	641	98.31%	ug/L	18	120	50	169000	1.00E+04	Federal MCL	1.69E+01	Yes	Max concentration > action level
Nitrite (ASN)	WET CHEM	1/21/1992	12/2/2008	627	20	3.19%	ug/L	3.28	657	5.6	4270	1.00E+03	Federal MCL	4.27E+00	No	Anomalous results; not identified a vadose zone target analyte

WAC 173-340-720(4), "Method Cleanup Levels for Potable Ground Water."
CCC = criteria continuous concentration
MCL = maximum contaminant level
RAD = radiological
VOC = Volatile Organic Compound
WAC = Washington Administrative Code
WET CHEM = wet chemistry

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Table D1-7. Groundwater COPCs and Recommended Analytical Methods for 100-IU2/IU6

Analyte Name	Analyte Class	Analytical Method	Units	EQL	Action Level	Action Level Basis
Antimony	Metal	Trace – ICP (6010) or ICP/MS (6020 or 200.8)	µg/L	5	5.60	Human Health for the Consumption of Water + Organism[1]
Arsenic	Metal	Trace – ICP (6010) or ICP/MS (6020 or 200.8)	µg/L	4	0.018	Human Health for the Consumption of Water + Organism[1]
Cadmium	Metal	Trace – ICP (6010) or ICP/MS (6020 or 200.8)	µg/L	2	0.25	Freshwater CCC
Cobalt	Metal	ICP Metals – 6010	µg/L	4	4.8	WAC 173-340-720(4)(b)(iii)(A) and (B)
Copper	Metal	ICP Metals – 6010	µg/L	8	9	Freshwater CCC[1]
Hexavalent Chromium	Metal	Chromium (hex) – 7196	µg/L	10	10	WAC 173-201A
Lead	Metal	Trace – ICP (6010) or ICP/MS (6020 or 200.8)	µg/L	2	2.1	WAC 173-201A
Manganese	Metal	ICP Metals – 6010	µg/L	5	50	40 CFR 143.3
Mercury	Metal	Mercury – 7470	µg/L	0.5	0.05	WAC 173-201A
Nickel	Metal	ICP Metals – 6010	µg/L	40	52	Freshwater CCC[1]
Thallium	Metal	Trace – ICP (6010) or ICP/MS (6020 or 200.8)	µg/L	2	0.24	Human Health for the Consumption of Water + Organism[1]
Zinc	Metal	ICP Metals – 6010	µg/L	10	91	WAC 173-201A
Americium-241	Radionuclide	Americium-241	pCi/L	1	15	40 CFR 141.66
Carbon-14	Radionuclide	Carbon-14	pCi/L	200	2,000	40 CFR 141.66
Cesium-137	Radionuclide	Gamma Energy Analysis	pCi/L	15	200	40 CFR 141.66
Cobalt-60	Radionuclide	Gamma Energy Analysis	pCi/L	25	100	40 CFR 141.66
Europium-152	Radionuclide	Gamma Energy Analysis	pCi/L	50	200	40 CFR 141.66
Europium-154	Radionuclide	Gamma Energy Analysis	pCi/L	50	60	40 CFR 141.66

Table D1-7. Groundwater COPCs and Recommended Analytical Methods for 100-IU2/IU6

Analyte Name	Analyte Class	Analytical Method	Units	EQL	Action Level	Action Level Basis
Europium-155	Radionuclide	Gamma Energy Analysis	pCi/L	50	600	40 CFR 141.66
Iodine-129	Radionuclide	Iodine-129 – Low Level	pCi/L	1	1	40 CFR 141.66
Strontium-90	Radionuclide	Strontium-90	pCi/L	2	8	40 CFR 141.66
Radium-228	Radionuclide	Gamma Energy Analysis	pCi/L	3	5	40 CFR 141.66
Technetium-99	Radionuclide	LSC - Technetium-99	pCi/L	15	900	40 CFR 141.66
Tritium	Radionuclide	LSC - Tritium	pCi/L	400	20,000	40 CFR 141.66
1,1-Dichloroethene	Volatile organic compound	Volatile Organics – 8260	µg/L	2	0.073	WAC 173-340-720(4)(b)(iii)(A) and (B)
Benzene	Volatile organic compound	Volatile Organics – 8260	µg/L	1.5	0.795	WAC 173-340-720(4)(b)(iii)(A) and (B)
Carbon Tetrachloride	Volatile organic compound	Volatile Organics – 8260	µg/L	1.0	0.23	Human Health for the Consumption of Water + Organism[1]
Chloroform	Volatile organic compound	Volatile Organics – 8260	µg/L	5	5.7	Human Health for the Consumption of Water + Organism[1]
Trichloroethene	Volatile organic compound	Volatile Organics – 8260	µg/L	0.5	0.49	WAC 173-340-720(4)(b)(iii)(A) and (B)
Tetrachloroethene	Volatile organic compound	Volatile Organics – 8260	µg/L	5	0.081	WAC 173-340-720(4)(b)(iii)(A) and (B)
Vinyl Chloride	Volatile organic compound	Volatile Organics – 8260	µg/L	10	0.025	Human Health for the Consumption of Water + Organism[1]
Total petroleum hydrocarbons – diesel range	TPH	Northwest Total Petroleum Hydrocarbons – Diesel (NWTPH-Dx)	µg/L	500	2,000	WAC 173-340-900, Table 720-1
Fluoride	Wet chemistry	Anions by IC - 300.0	µg/L	500	960	WAC 173-340-720(4)(b)(iii)(A) and (B)
Nitrate	Wet chemistry	Anions by IC - 300.0	µg/L	250	10,000	40 CFR 141.62

Table D1-7. Groundwater COPCs and Recommended Analytical Methods for 100-IU2/IU6

Analyte Name	Analyte Class	Analytical Method	Units	EQL	Action Level	Action Level Basis

Notes: For four digit EPA methods, see SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B. For EPA Method 200.8, see EPA/600/R-94/111, Methods for the Determination of Metals in Environmental Samples, Supplement 1. For EPA Method 300.0, see EPA/600/4-79/020, Methods of Chemical Analysis of Water and Wastes.

WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington."

National recommended Water Quality Criteria Table (ambient water quality criteria for aquatic life and human health) at www.epa.gov/waterscience/criteria/wqctable/index.html

CCC = criteria continuous concentration
CFR = Code of Federal Regulations
CRDL = Contract Required Detection Level
EPA = Environmental Protection Agency
IC = ion chromatography
ICP = inductively coupled plasma
MS = mass spectrometry
WAC = Washington Administrative Code

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D2 Identification of Contaminants of Potential Concern for Groundwater Portion of the 100-F Remedial Investigation/Feasibility Study Work Plan

Environmental Calculation Cover Page

Calculation No.: ECF-100FR3-10-0329 Revision No.: 0

Project: Soil and Groundwater Remediation Date: 3/17/10

Calculation Title & Description: Identification of Contaminants of Potential Concern (COPC) for Groundwater Portion of the 100-FR3 Groundwater Operable Unit Remedial Investigation/Feasibility Study Work Plan

This calculation brief describes the selection of contaminants of potential concern for defining baseline nature and extent groundwater conditions at the 100-FR-3 Groundwater Operable Unit.

Revision History:

Revision No.	Description	Date	Affected Pages
0	Groundwater COPC selection process prepared to support DOE/RL-2008-46-ADD4 Rev.0	3-17-2010	All

Document Review & Approval:

Originator: Kristin Singleton/Risk Assessor
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Signature Date 3-17-10

Senior Reviewer: Donna Morgans/Senior Risk Assessor
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Responsible Manager: Alaa Aly/ Modeling and Risk Integration Manager
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Signature Date 3/17/2010

D2.1 Purpose

This memorandum describes the method for selecting groundwater contaminants of potential concern (COPCs) in support of developing 100-F remedial investigation/feasibility study work plan documents. A secondary objective of this memorandum is to identify the appropriate analytical methods for the COPCs. The recommended analytical methods for radiological and nonradiological COPCs are based on their ability to achieve their respective action level.

The list of COPCs identified with this method will be used for planning future risk assessment activities for the 100-F. These COPCs also will be used in the nature and extent characterization for the 100-F. The identified COPCs can be used to develop a more focused list of analytes for sampling and analysis plans, such as remedial process optimization.

The source of analytical data and selection criteria for identifying COPCs are described in Section 2, Methodology. Presentations were given to the Tri-Parties (U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology) on December 16, 2008, and January 6, 2009, to provide an overview of the processes used to identify vadose zone soil target analytes and groundwater COPCs. A COPC is an analyte suspected of being associated with site-related activities that represents a potential threat to human health or the environment, and analyte data are of sufficient quality for use in a quantitative baseline risk assessment. COPCs will be carried into the SAP for characterization or developing baseline conditions through sampling and analysis by approved analytical methods.

D2.2 Methodology

The evaluation methodology involves a sequence of steps, consisting of 1) extracting and processing an OU-specific analytical data set, 2) screening the data for the entire groundwater OU to select analytes that qualify as initial COPCs for inclusion in the sampling and analysis plan.

D2.2.1 Analytical Data Processing

The data set obtained from HEIS includes the following types of information:

- Unfiltered and filtered analytical results
- Data qualification and data validation flags, including rejected results
- Results reported by more than one analytical method
- Parent, field duplicate, and field split samples

As a result of these database qualities, the analytical data obtained from the HEIS database are processed to identify one set of results per sampling location and time of collection. The following describes the data processing steps taken before the selection of groundwater COPCs. Figure D2-1 presents the analytical data processing requirements associated with the groundwater COPC selection process and the number of records associated with each of the processing steps.

Unfiltered Sample Results. Only unfiltered nonradiological and radiological results are used for selecting COPCs. Use of unfiltered sampling results represents total concentrations of the analyte. Use of filtered sampling results may underestimate chemical and radiological concentrations in water from an unfiltered tap and are not used for the COPC selection process.

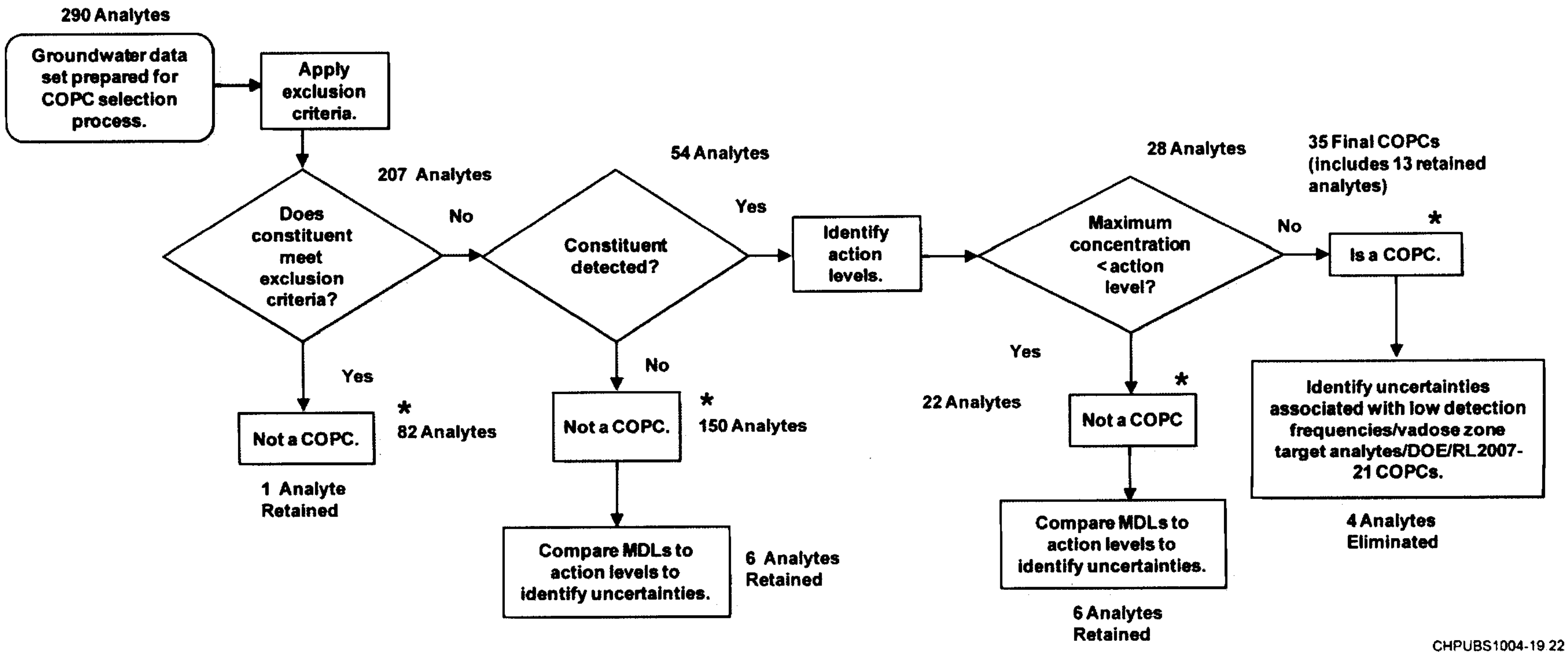


Figure D2-1. Analytical Data Processing for COPC Selection Process

Field Duplicate and Split Results. Field quality control samples (field duplicates and field splits) are collected in the field and analyzed by the laboratory as unique samples. The parent sample and quality control samples are collected from the same location (i.e., monitoring well), resulting in more than one sample per location. The following criteria were presented to reduce multiple sample results from one location to a single result.

- If two or more detections exist, the maximum concentration will be used.
- If one detection and one nondetection exist, the detected concentration will be used.
- If two or more nondetections exist, the lowest detection limit will be used

Laboratory and Data Validation Flags. After receiving analytical data with data qualification flags from the laboratory, validation qualifiers are assigned during the data validation process. The following rules are applied to determine how the sample results can be used for selecting COPCs.

- All sample results flagged with a "U" qualifier or combination of qualifiers that include a "U," such as a "UJ," are considered a nondetected concentration.
- All sample results without a "U" qualifier are considered detected concentrations, including results without a qualifier or with a "J" qualifier.
- No sample data rejected and flagged with "R" are used for selecting COPCs.

Analytes Reported by Numerous Analytical Methods. An analyte can often be reported by more than one analytical method resulting in multiple results for the same analyte from the same location. When analytes are reported by more than one analytical method, results will be processed to select the method that provides the most reliable results. For example, the gamma spectroscopy method will provide concentration results for the uranium isotopes; however, uranium concentrations should be reported by a uranium-isotope-specific method.

D2.2.2 Identify Action Levels

Action levels are derived from readily available sources of chemical-specific applicable or relevant and appropriate requirements (ARARs) or risk-based preliminary remediation goals (PRGs) developed using U.S. Environmental Protection Agency (EPA) health criteria and default exposure assumptions. Table D2-1 identifies all sources of chemical-specific ARARs and (PRGs) for each of the 246 analytes reported. The action level represents the lowest of the available values for each analyte evaluated. A description of the sources of available chemical-specific ARARs and PRGs follows. A description of how the action levels are used in the COPC selection process is provided in the Section 5.

D2.2.2.1 ARAR-Based Remediation Goals

Potential chemical-specific ARARs include concentration limits set by federal environmental regulations such as maximum contaminant levels (MCLs), secondary MCLs, and non-zero maximum contaminant level goals established under the *Safe Drinking Water Act of 1974*, ambient water quality criteria established under the *Clean Water Act of 1977*, and Washington State regulations (WAC 173-340-720, "Model Toxics Control Act--Cleanup," "Groundwater Cleanup Standards;" WAC 173-340-730, "Surface Water Cleanup Standards;" and WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington").

Uranium isotopes are not identified as COPCs because the MCL for uranium (metal) is considered protective of kidney toxicity and carcinogenicity. The following excerpt is taken from the National Primary Drinking Water Regulations to describe the basis for the uranium MCL:

"Exposure to uranium in drinking water may cause toxic effects to the kidney. In 1991, EPA proposed an MCL of 20 µg/L, which was determined to be as close as feasible to the maximum contaminant level goal(MCLG). Based on human kidney toxicity data collected since that time and on its estimate of the cost and benefits of regulating uranium in drinking water, EPA determined that the benefits of a uranium MCL of 20 µg/L did not justify the costs. Instead, EPA determined that 30 µg/L is the appropriate MCL, because it maximizes the net benefits (benefits minus costs) while being protective of kidney toxicity and carcinogenicity with an adequate margin of safety."

D2.2.2.2 Risk-Based Preliminary Remediation Goals

The risk-based concentration table for residential tap waters is used as the source of PRGs. These values are obtained from the "Regional Screening Levels for Chemicals Contaminants at Superfund Sites," available at: (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm). The PRGs for chemicals with carcinogenic effects corresponds to a 10^{-6} incremental risk of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen from all significant exposure pathways for a given medium. The PRGs for chemicals with noncancerous effects corresponds to a hazard index of one, which is the level of exposure to a chemical from all significant exposure pathways in a given medium below which it is unlikely for even sensitive populations to experience adverse health effects. The direct contact exposure pathway for groundwater considers exposure from ingestion, inhalation of vapors, and dermal contact. The residential tap waters value is used only when a chemical-specific ARAR is not available.

D2.2.3 Identify Groundwater COPCs

The following process is used to select groundwater COPCs for the 100-F. This process is used to identify COPCs in support of developing 100-F remedial investigation/feasibility study work plan documents. The steps used in the COPC selection process are as described below. A flowchart presenting the COPC selection process and the number of records associated with each of the COPC selection process steps is shown in Figure D2-2.

D2.2.3.1 Apply Exclusion Criteria

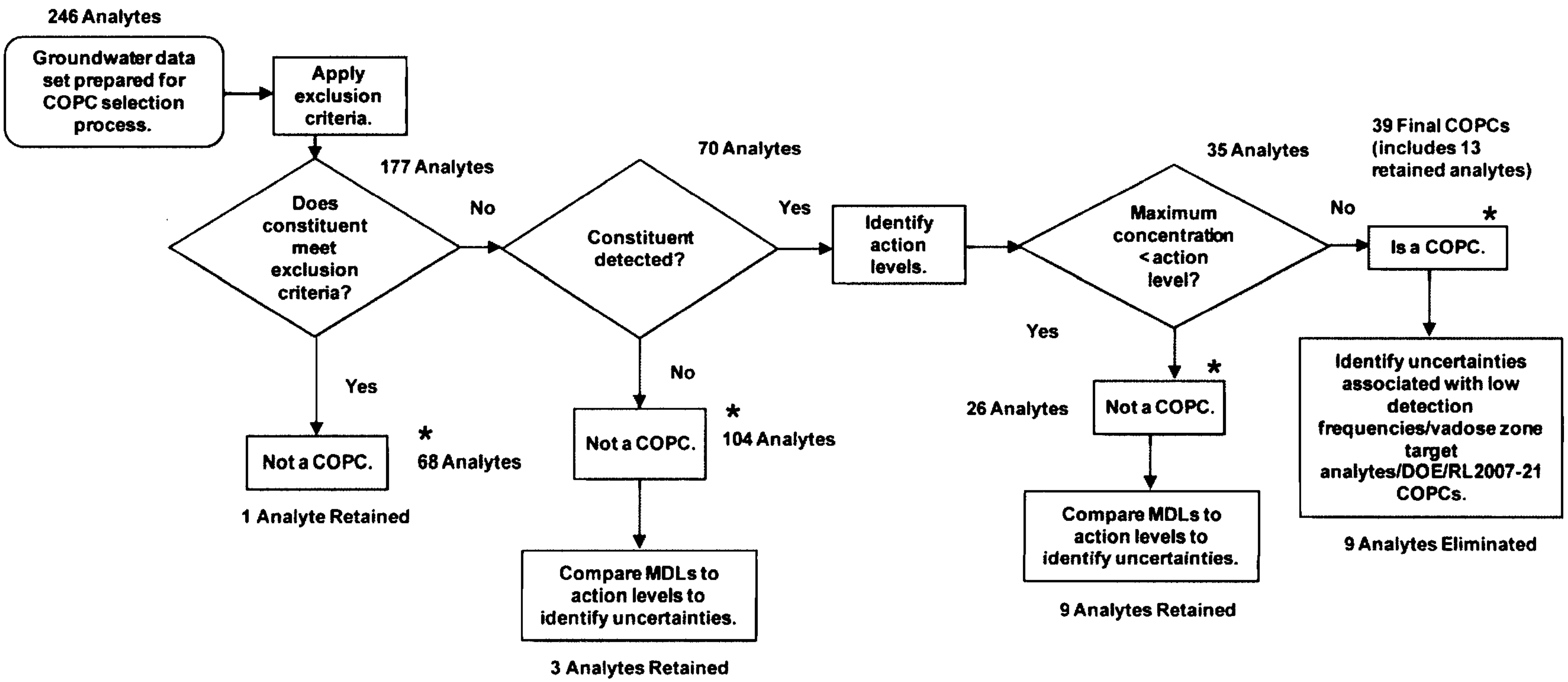
Analytes that meet exclusion criteria are eliminated as COPCs. Analytes that do not meet the exclusion criteria are carried forward into the next step of the process.

- Naturally-occurring radionuclides associated with background radiation
- Radionuclides with half-lives of less than 3 years and do not have "significant daughter products"
- Essential nutrients (minerals)
- Common laboratory contaminants
- Water quality parameters
- Contaminants with no known toxicity information

D2.2.3.2 Identify Nondetected Analytes

Analytes that have been collected from appropriate locations, have adequate detection limits, and that have not been detected in any of the groundwater samples for an area are eliminated as COPCs. All analytes detected at least once are carried forward to the next step of the process.

Uncertainty Analysis. An additional evaluation was performed on those analytes that were reported with minimum method detection limits (MDLs) greater than their respective action level.



Note: *Review vadose zone soil target analytes to determine if groundwater COPCs should be added.

CHPUBS1004-19.23

Figure D2-2. COPC Selection – A Multi-Step Process

D2.2.3.3 Analytes with Maximum Detected Concentrations Less Than Action Levels

Maximum concentrations of analytes detected in groundwater are compared to action levels to identify analytes that are not likely to significantly contribute to overall risk. If the maximum detected concentration of an analyte is less than its action level, the analyte is eliminated as a COPC unless the uncertainty analysis indicates otherwise.

Uncertainty Analysis. An additional evaluation was performed on those analytes that were detected at concentrations slightly less than their respective action level (i.e., the maximum detected concentration is at least one-tenth the action level or within one order of magnitude). The purpose of this evaluation is to determine if there is the potential for underestimating cumulative effects when concentrations of analytes are near but do not exceed the action level. Additionally, minimum and maximum MDLs associated with these analytes are evaluated to determine if they are adequate for confirming their presence or absence at their respective action levels. If the MDLs are greater than the action level and it is identified as a soil target analyte, then the analyte will be identified as a COPC. An additional consideration for inclusion as a COPC is the abundance of analytical results to determine the presence of an analyte or radioisotope.

D2.2.3.4 Identify Analytes with Maximum Detected Concentrations Greater Than Action Levels

Maximum concentrations of analytes detected in groundwater are compared to action levels to identify analytes that are likely to contribute to overall risk. If the maximum detected concentration of an analyte is greater than its action level, the analyte is identified as a COPC unless the uncertainty analysis indicates otherwise.

Uncertainty Analysis. An additional evaluation was performed to distinguish those analytes that were detected infrequently and are not reproducible from those analytes that could be associated with a potential hot spot or localized area of contamination near a monitoring well.

D2.2.3.5 Final Evaluation of Groundwater COPCs

The final step is used to confirm the list of groundwater COPCs is consistent with what is known about Hanford Site operations and is compared to the vadose zone soil target analyte list and DOE/RL-2007-21, *Risk Assessment Report for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment.*

D2.3 Assumptions and Inputs

D2.3.1 Groundwater Set Used for COPC Selection

The analytical data set used in this evaluation was extracted from the Hanford Environmental Information System (HEIS) database. Groundwater data for this analysis were obtained from monitoring wells and compliance wells. Although groundwater data collected from injection wells, extraction wells, and aquifer tubes can be used with monitoring and compliance data for purposes, such as remedy selection and design, these other data are not used for risk assessment.

A work plan to characterize the nature and extent of contamination in groundwater and associated potential exposures has not been written. Rather, the U.S. Department of Energy monitors groundwater at the Hanford Site to fulfill a variety of state and federal regulations, including the *Atomic Energy Act of 1954*, the *Resource Conservation and Recovery Act of 1976*, the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, and WAC 173-340. Data collected to fulfill monitoring requirements provide a comprehensive data set for identifying COPCs in groundwater.

Although they can be used for risk assessment, monitoring data do have associated uncertainties. The uncertainties associated with the groundwater data set are described in DOE/RL-2007-21, Volume 2.

Specifically, the analytes, sampling frequencies, and MDLs (or reporting limits) are used to meet different regulatory program requirements. Additionally, quality assurance and quality control requirements can vary between programs. As a result, data may be flagged for suitability during validation and these flags may limit the use of the data. Because of these differences, a consistent chemical "snapshot" of current groundwater conditions is needed.

The groundwater data set used for COPC selection consists of sampling and analysis data collected from 21 monitoring wells from the 100-FR-3 Groundwater Operable Unit. Table D2-2 provides a list of the monitoring wells used in this evaluation. The sampling and analysis data were collected between February 11, 1992 and February 3, 2009. This groundwater data set includes the quarterly analysis of groundwater samples (a total of four consecutive quarterly rounds) collected during 1992 and 1993 and reported in the 1995 limited field investigation for the 100-FR-3 Groundwater Operable Unit (DOE/RL-95-99, *100-FR-3 Groundwater/Soil Gas Supplemental Limited Field Investigation Report*). These data were used for the ecological component of the qualitative risk assessment (WHC-SD-EN-RA-012, *Qualitative Risk Assessment for the 100-FR-3 Groundwater Operable Unit*). As stated previously, the data collected to fulfill monitoring requirements provide a comprehensive data set for identifying COPCs in groundwater. A total of 43,580 records were obtained from the HEIS database, and a total of 246 analytes are reported in this data set.

D2.4 Software Applications

Software used for this analysis included HEIS, Microsoft Access[3] database software, and Microsoft Excel.[4] The HEIS database is a central repository for storing and maintaining access to environmental data collected and analyzed for the Hanford Site. Microsoft Access was used query and sort the data downloaded from the HEIS database. Microsoft Excel was used to present the groundwater data and information in spreadsheets. No statistical calculations were performed.

D2.5 Calculation

This section summarizes the outcome of the methodology described for identification of groundwater COPCs for the 100-FR-3 groundwater OU.

D2.5.1 Apply Exclusion Criteria

Sixty-six of the 246 analytes meet the exclusion criteria and are listed in Table D2-3. Sampling dates, minimum and maximum detected concentrations, minimum and maximum method detection limits (MDLs), and the basis for their exclusion also are provided in Table D2-3. The following define the exclusion criteria that are applied:

Background Radiation. Naturally-occurring radionuclides associated with background radiation (potassium-40, radium-226, thorium-228, and thorium-232) were measured in groundwater from the 100-F and are eliminated as COPCs.

Radionuclides with a half-life of less than three years and do not have significant daughter products. Radioisotopes with half-lives less than or equal to three years are eliminated from further consideration because only a small fraction of activity remains after 30 years of decay. Nineteen radioisotopes met this exclusion criteria and are eliminated from further consideration as COPCs. Only antimony-125 and ruthenium-106 were reported with measureable concentrations in groundwater. Neither of these

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[3] Access is a trademark of Microsoft Corporation, Redmond, Washington.

[4] Excel is a trademark of Microsoft Corporation, Redmond, Washington.

radioisotopes are significant daughter products of decay chain and are therefore not identified as groundwater COPCs.

Essential Nutrients. Essential nutrients are those constituents considered essential for human nutrition. Essential nutrients (calcium, magnesium, potassium, and sodium) were measured in groundwater and are excluded from further consideration as COPCs.

Common Laboratory Contaminants. Methylene chloride, acetone, and bis(2-ethylhexyl) phthalate are considered by EPA to be common laboratory contaminants. Common laboratory contaminants are introduced as a result of laboratory analysis procedures after the sample collection and are not related to the Hanford Site. Methylene chloride, acetone, and bis(2-ethylhexyl) phthalate were detected in groundwater at concentrations that would indicate they are common laboratory contaminants, therefore they are eliminated from further consideration as COPCs.

Water Quality Parameters. Water quality parameters that represent physical and biological characteristics, such as temperature, pH, or turbidity, are eliminated as COPCs. In all cases, water quality parameters do not have available toxicological information and cannot be evaluated for exposure purposes. Eleven water quality parameters were measured in groundwater from the 100-F and are eliminated from further consideration as COPCs.

Analytes without Action Levels. Analytes without an action level are eliminated as COPCs because a promulgated chemical-specific ARAR is not published from the list of sources. Twenty-eight analytes are eliminated because an action level is not available. The analytes that do not have action levels represent some analytes that have been detected in groundwater and others that have not been detected. Fourteen analytes without an action level have not been detected (one metal, two pesticides, two radioisotope, four semivolatile organic compounds [SVOCs], three volatile organic compounds [VOCs], and two water quality parameters). The remaining 14 analytes (one metal, five radioisotopes [including four uranium isotopes], one SVOC, one VOC, and six water quality parameters) were detected at least once.

With the exception of the uranium isotopes, gross beta, and two pesticides (endrin ketone and delta-BHC), the analytes eliminated as COPCs are wet chemistry parameters, VOCs, or SVOC that are opportunistically reported with an analytical suite and are not known to be associated with historical operations at the Hanford Site.

Although the uranium isotopes do not have a promulgated MCL they do have toxicity information available.The uranium isotopes were detected at concentrations ranging from less than 1 pCi/L to 11 pCi/L. Uranium isotopes do not have a promulgated drinking water standard. All uranium isotope concentrations are below the proposed MCL value of 20 pCi/L. Additionally, total uranium (metal) is not identified as a COPC for the 100-F.

Gross beta is frequently analyzed in groundwater samples as an indicator parameter. The standard for beta particles and photon emitters is a combined 4 mrem/yr. The maximum gross beta concentration is 918 µg/L, indicating the presence of a beta emitter such as strontium-90. Strontium-90 has been identified as a groundwater COPC. Gross beta is not identified as a groundwater COPC; but will be analyzed for groundwater samples.

Niobium-94 and thorium-234 have available toxicity information but they do not have an published federal MCLs for comparison purposes. Additionally these isotopes were not detected in groundwater therefore they are not identified as groundwater COPCs.

Endrin ketone and delta-BHC have not been detected and do not have action levels. Endrin and endrin aldehyde are structurally similar to endrin ketone and have action levels. Endrin has not been detected in groundwater and its minimum MDL is less than its action level. Endrin aldehyde has been detected in groundwater once, with a maximum concentration and minimum MDL less than its action level. Gamma-BHC is structurally similar to delta-BHC and has an action level. Gamma-BHC has not been detected in groundwater and the minimum MDL was slightly greater than the action level. Based on these comparisons, endrin ketone and delta-BHC are not present in groundwater at levels at or near a similar action level and are not identified as COPCs.

D2.5.2 Identify Nondetected Analytes

Of the 246 analytes, 107 analytes have not been detected in the 100-F and are listed in Table D2-4. Table D2-4 also provides sampling dates, minimum and maximum MDLs, the action level, basis of the action level, and the level of exceedance. The minimum MDL is divided by the action level to determine the level of exceedance. The purpose of determining the minimum level of exceedance is to identify those analytes with MDLs that have not met the action level to date versus those analytes with MDLs that have met the action level at least some of the time.

One metal, seven polychlorinated biphenyls (PCBs), 16 pesticides, 4 radioisotopes (plutonium-239, europium-152, europium-155, and thorium-230), 53 SVOCs, 25 VOCs, and one wet chemistry parameter were analyzed, but were not detected and are not considered COPCs.

Uncertainty Analysis. Fifty-five analytes were reported with minimum MDLs greater than their respective action level. The analytical method selected is unable to detect the analyte at or below the action level.

Europium-152, europium-155, plutonium-239, and throium-230 were not detected in any groundwater sample. Europium-152 and europium-155 were analyzed in 75 and 49 samples respectively, suggesting the absence of these radioisotopes. Plutonium-239 was analyzed in three samples and also reported in combination with plutonium-239/240 (see Table D2-5). Plutonium-239/240 was analyzed in 65 groundwater samples with one detection, these results suggest the absence of this isotope in groundwater. Thorium-230 was analyzed in three samples and is identified as groundwater COPC due to the lack of available data to determine the presence or absence of these isotopes in groundwater.

Twenty-four analytes with MDLs greater than their action level represent SVOCs. With the exception of polynuclear aromatic hydrocarbons (PAHs), the remainder of the SVOCs are not known or suspected to be associated with Hanford Site operations. Seven PAHs of the 16 PAHs reported have not been detected in groundwater but their minimum MDLs are approximately 2,600 times greater than their respective action levels. EPA Method 8270 (SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*) currently is used to analyze for PAHs in groundwater. A comparison of MDLs between the historic and current analytical methods shows no difference in MDLs. This indicates that the current analytical method cannot attain MDLs at the action level and would not reduce the uncertainties associated with the ability to confirm the analytes' presence at or below the action levels. Generally, PAHs are immobile in soil and are not expected to migrate from vadose zone into groundwater. However, lower molecular weight PAHs such as acenaphthene, anthracene, fluorene, and naphthalene have the potential to be more mobile than higher molecular weight PAHs. Additionally, PAHs can form hydrophobic bonds to co-located organic which also creates the potential to mobilize PAHs. Because nine of the 16 PAHs reported achieved MDLs less than their respective action level suggests the overall absence of PAHs in groundwater, therefore PAHs are not expected to be present in groundwater and are not identified as COPCs.

Ten analytes with MDLs greater than their action level represent VOCs. With the exception of styrene and vinyl chloride, VOCs that are undetected are not known or suspected to be associated with Hanford

Site operations. Vinyl chloride was not detected in groundwater samples; however, the MDLs for vinyl chloride ranged from 0.07 μg/L to 10 μg/L which exceed the action level of 0.025 μg/L. Styrene was not detected in groundwater samples; however, all MDLs were greater than the action level of 1.46 μg/L. Because the MDLs for styrene and vinyl chloride are greater than the action level, they will be included as COPCs to confirm that nondetected concentrations are below the action level.

Seven PCBs were reported with MDLs greater than their respective action levels. PCBs have been associated with some Hanford Site operations. PCB MDLs were 6,250 times greater than their respective action levels. EPA Method 8082 currently is used to analyze for PCBs in groundwater. A comparison of MDLs between historic and current analytical methods shows little to no difference in MDLs. This indicates that current analytical method cannot attain MDLs at the action level and would not reduce the uncertainties associated with the ability to confirm the analytes' presence at or below the action levels. Generally, PCBs are immobile in soil and are not expected to migrate from the vadose zone into groundwater; therefore, PCBs are not expected to be present in groundwater and are not identified as COPCs.

Thirteen pesticides were reported with MDLs greater than their respective action levels. Pesticides have been applied to areas within the 100 Area. Pesticide MDLs ranged from 1.3 to approximately 980 times greater than the action levels. EPA Method 8081 currently is used to analyze for pesticides in groundwater. A comparison of MDLs between historic and current analytical methods show little to no difference in MDLs. This indicates that current analytical methods cannot attain MDLs at the action level and would not reduce the uncertainties associated with the ability to confirm the analytes' presence at or below the action levels; therefore, pesticides are not identified as COPCs.

Cyanide was not detected in any of the groundwater samples analyzed between 1992 and 1994; however, all MDLs are greater than its action level of 5.2 μg/L. Cyanide is not identified as a vadose zone soil target analyte and is not expected of being present in soil or groundwater; therefore cyanide is not identified as a COPC.

D2.5.3 Analytes with Maximum Detected Concentrations Less Than Action Levels

Table D2-5 presents a summary of the analytes with maximum detected concentrations less than their respective action level. Thirty-six analytes were detected at least once, but their maximum detected concentrations are less than their respective action levels. The level the maximum detected concentration did not exceed the action level associated with this group of analytes ranged from 4.17E-4 to 0.90. The maximum detected concentration is divided by the action level to determine the amount the action level was not exceeded.

D2.5.3.1 Uncertainty Analysis

The analytes with maximum detected concentrations greater than one-tenth of their respective action level are 1,2-dichloroethane, 1,4-dichlorbenzene, barium, carbon-14, chloride, endrin aldehyde, iodine-129, lithium, nitrite, strontium, uranium, and vanadium. 1,2-Dichloroethane, and 1,4-dichlorobenzene are reported with maximum MDLs greater than their respective action levels.

1,2-Dichloroethane. 1,2-Dichloroethane was detected in four of 304 water samples (1.3 percent frequency) analyzed from 1992 to 2009. Of the 300 nondetected results, 177 MDLs were greater than the action level of 0.38 μg/L. 1,2-Dichloroethane is not identified as a vadose zone target analyte and is not suspected of being released to the soil. Based on the results of this evaluation, 1,2-dichloroethane is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

1,4-Dichlorobenzene. 1,4-Dichlorobenzene was detected in four of 237 water samples (1.7 percent frequency) analyzed from 1992 to 2009. Of the 233 nondetected results, 101 MDLs were greater than the action level of 1.82 µg/L. 1,4-Dichlorobenzene is not identified as a vadose zone target analyte and is not suspected of being released to the soil. Based on the results of this evaluation, 1,4-dichlorobenzene is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Barium. Barium was detected in 220 of 221 samples (100 percent frequency) collected between 1992 and 2009. All detected concentrations and MDLs are consistently below the action level. Based on the results of this evaluation, barium is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Carbon-14. Carbon-14 was detected in 45 of 147 samples (31 percent frequency) collected between 1992 and 2002. All detected concentrations and MDLs are consistently below the action level. Carbon-14 is not identified as a vadose zone soil target analyte and it is not expected to be present in soil or groundwater. Based on the results of this evaluation, carbon-14 is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Chloride. Chloride was detected in all water samples collected between 1992 and 2009. All detected concentrations are consistently below the action level. Based on the results of this evaluation, chloride is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Endrin aldehyde. Endrin aldehyde was detected in one of 99 water samples analyzed (1.0 percent frequency). Endrin aldehyde was measured in well 199-F5-45 (B08Y51) on July 17, 1993 at a concentration of 0.078 µg/L with a "J" qualifier. This analyte was not detected in the two previous or two subsequent sampling rounds at this location. All detected concentrations and MDLs are consistently below the action level. Based on the results of this evaluation, endrin aldehyde is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Iodine-129. Iodine-129 was detected in one of four samples (25 percent frequency) analyzed between 1994 and 2000. Iodine-129 was measured in well 699-27-8 (B0JPS4) in 1996 at a concentration of 0.14 pCi/L. The analyte was not detected in subsequent sampling rounds at this location. All detected concentrations and MDLs are less than the action level. Iodine-129 is not identified as a vadose zone soil target analyte and it is not expected to be present in soil or groundwater. Based on the results of this evaluation, iodine-129 is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Lithium. Lithium was detected in all three samples analyzed between 2005 and 2006. Lithium was measured in wells 199-F5-1 (J10889), 199-F5-6 (J10891), and 199-F8-3 (J111V9) with a maximum concentration of 22.2 µg/L. Lithium is not identified as a vadose zone soil target analyte and it is not expected to be present in soil or groundwater. Based on the results of this evaluation, lithium is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Nitrite. Nitrite was detected in four of 235 samples (1.7 percent frequency) between 1992 and 2009. Nitrite is not identified as a vadose zone soil target analyte and all concentration and MDLs are consistently below the action level. Based on the results of this evaluation, nitrite is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Strontium. Strontium was detected in 69 of 70 samples (99 percent frequency) between 1997 and 2009. All detected concentrations and MDLs are consistently below the action level. Strontium is not identified as a vadose zone soil target analyte and it is not expected to be present in soil or groundwater. Based on the results of this evaluation, strontium is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Uranium. Uranium was detected in 78 of 80 samples (98 percent frequency) between 1992 and 2009. All detected concentrations and MDLs are consistently below the action level. Uranium is not identified as a vadose zone soil target analyte and it is not expected to be present in soil or groundwater. Based on the results of this evaluation, uranium is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Vanadium. Vanadium was detected in 131 of 221 samples (59 percent frequency) collected between 1992 and 2009. Although vanadium is identified as a vadose zone soil target analyte, all concentrations and MDLs are consistently below the action level. Based on the results of this evaluation, vanadium is eliminated from consideration as a COPC and its exclusion would not likely underestimate overall cumulative effects.

Americium-241, plutonium-238, plutonium-239/240 are alpha-emitting isotopes that have been detected in groundwater, additionally gross alpha results are greater than the 15 pCi/L federal MCL suggesting the presence of alpha-emitting isotopes. Carbon-14, cesium-137, cobalt-60, europium-154, iodine-129, and technetium-99 are beta emitting isotopes that have been detected in groundwater. Most of the isotopes do not have current analytical results for this operable unit, therefore these radioisotopes are identified as groundwater COPCs to determine the amount these isotopes contribute to the 4 mem/yr standard for beta emitters.

D2.5.4 Identify Analytes with Maximum Detected Concentrations Greater Than Action Levels

Thirty-seven of 246 analytes were detected at least once and their maximum detected concentrations are greater than their respective action levels. Table D2-6 provides a summary of the analytes with maximum detected concentrations greater than their respective action level. An uncertainty analysis was performed to distinguish analytes that are infrequently detected and are not reproducible from those that could be associated with a potential hot spot or localized area of contamination near a monitoring well.

D2.5.4.1 Uncertainty Analysis

Nine analytes (1,1-dichloroethene, benzene, cadmium, carbon tetrachloride, cobalt, heptachlor, heptachlor epoxide, mercury, and tetrachloroethene) are detected at low frequencies (i.e., less than 5 percent).

1,1-Dichloroethene. 1,1-Dichloroethene was detected in one of 176 samples (0.57 percent frequency) collected between 1992 and 2009. The single detection of 1,1-dichloroethene was measured in well 199-F7-2 (B0BMV6) at a concentration of 1 μg/L. This analyte was not detected in four previous or five subsequent sampling rounds at this location. Of the nondetected concentrations, 169 are greater than the action level. 1,1-Dichloroethene is not identified as a vadose zone target analyte, but it is considered a potential breakdown product of trichloroethene. Based on the results of this evaluation, 1,1-dichloroethene is identified as a groundwater COPC.

Benzene. Benzene was detected in one of 304 samples (0.33 percent frequency) collected between 1992 and 2009. The single detection of benzene was measured in well 199-F7-2 (B0BMV6) at a concentration of 2.0 μg/L. This analyte was not detected in four previous or 12 subsequent sampling rounds at this location. Of the nondetected concentrations, 289 are greater than the action level of 0.0795 μg/L .

Benzene is not identified as a vadose zone target analyte and is not expected to be present in soil or groundwater. Based on the results of this evaluation, benzene is not identified as a groundwater COPC.

Cadmium. Cadmium was detected in five of 221 samples (2.3 percent frequency) collected between 1992 and 2009. All detected concentration are greater than the action level of 0.25 µg/L. Of the 216 nondetected concentrations, all but one MDL was greater than the action level. Cadmium is identified as a vadose zone target analyte. Based on the results of this evaluation, cadmium is identified as a groundwater COPC.

Carbon tetrachloride. Carbon tetrachloride was detected in five of 304 samples (1.6 percent frequency) between 1992 and 2009 with concentrations above the action level. Carbon tetrachloride was detected above the action level of 0.23 µg/L at wells 199-F5-43A (B0BMR4), 199-F6-1 (B0BMT8), 199-F7-2 (B0R0M5), and 199-F8-4 (B0R1R6) between 1994 and 1998. Of the nondetected concentrations, 202 MDLs are greater than the action level. Carbon tetrachloride is not identified as a vadose zone soil target analyte. Based on the results of this evaluation, carbon tetrachloride is identified as a groundwater COPC.

Cobalt. Cobalt was detected in three of 221 samples (1.4 percent frequency) between 1992 and 2009 with concentrations above the action level. The three detections exceeded the action limit of 4.8 µg/L. Cobalt was reported at a concentration of 8 µg/L flagged with a "B" qualifier at well 199-F5-4 (B0D7Z8) in 1994; it was not detected in the five previous or six subsequent sampling rounds at this location. Cobalt was reported at a concentration of 11.6 µg/L flagged with a "C" qualifier at well 199-F5-43A (B1PVF1) in 2007; it was not detected in the ten previous sampling rounds at this location. Cobalt was reported at a concentration of 12.7 µg/L flagged with a "C" qualifier at well 199-F5-44 (B1PVF9) in 2007; it was not detected in the ten previous sampling rounds. Of the nondetected results, 183 MDLs are less than and 35 are greater than or equal to the action limit. Cobalt is identified as a vadose zone soil target analyte and is expected to be present in the soil. Based on the results of this evaluation, cobalt is identified as a groundwater COPC. ***Heptachlor.*** Heptachlor was detected in one of 99 samples (1 percent frequency) collected between 1992 and 2006. The single detection was measured in well 199-F5-3 (B08Y21) at a concentration above the action level in 1993. Heptachlor was not detected in the two previous or one subsequent sampling rounds at this location. Heptachlor is not identified as a vadose zone soil target analyte and is not expected to be present in soil. Based on the results of this evaluation, heptachlor is not identified as a groundwater COPC.

Heptachlor epoxide. Heptachlor epoxide was detected in three of 99 samples (3.0 percent frequency) collected between 1992 and 2006. Heptachlor epoxide was detected in well 199-F5-1 (J10889) during 2005, but was not detected in the five previous sampling rounds conducted. Heptachlor epoxide was detected in well 199-F8-2 (B09DF0) during 1993, but was not detected in the three previous or one subsequent round. Heptachlor epoxide was detected in well 199-F8-3 (B09DF4) during 1993, but was not detected in the three previous or two subsequent rounds. Heptachlor epoxide is identified as a vadose zone soil target analyte is not expected to be present in soil. Based on the results of this evaluation, heptachlor epoxide is not identified as a groundwater COPC.

Mercury. Mercury was detected once in 97 samples (1.0 percent frequency) collected between 1992 and 2006. Mercury was detected in 1993 in well 199-F8-4 (B07RB6) at a concentration of 0.2 µg/L and flagged with a "B" qualifier; mercury was not detected in the two previous or two subsequent sampling rounds at this location. All 96 nondetected results reported MDLs greater than the action level of 0.012 µg/L. Mercury is identified as a vadose zone soil target analyte and is expected to be present in soil. Based on the results of this evaluation, mercury is identified as a groundwater COPC.

Tetrachloroethene. Tetrachloroethene (PCE) was detected in three of 304 samples (1.0 percent frequency) collected between 1992 and 2009. PCE was detected at three locations above the action level of 0.081 μg/L. PCE was detected in well 199-F5-43A (B0BMR4) during 1994, but was not detected in the four previous or the nine subsequent sampling rounds. PCE was detected in well 199-F5-6 (B05WN2) during 1992, but was not detected in subsequent sampling rounds conducted. PCE was detected in well 199-F8-7 (B1Y5P3) during 2009, but was not detected in the previous sampling round. Of the nondetected results, 285 MDLs are greater than the action level of 0.081 μg/L. PCE is identified as a vadose zone soil target analyte and is expected to be present in soil. Based on the results of this evaluation, PCE is identified as a groundwater COPC.

D2.5.5 Final Evaluation of Groundwater COPCs

The last step of the COPC selection process is used to confirm the list of groundwater COPCs is consistent with what is known about Hanford Site operations and is compared to the vadose zone soil target analyte list and DOE/RL-2007-21.

Gross Alpha. Gross alpha is frequently analyzed in groundwater samples as an indicator parameter. The alpha emitters, americium-241, plutonium-238, plutonium-239/240 are COPCs. Gross alpha is not identified as a groundwater COPC; but will be analyzed for groundwater samples.

Hydrazine. Hydrazine was analyzed for and detected in groundwater samples collected from 1993 to 1994. Although the maximum detected concentration of hydrazine is greater than its action level, hydrazine is not known to be persistent in the environment. Additionally, hydrazine is not identified as a target analyte for vadose zone soil and is not identified as a contaminant of concern in DOE/RL-2007-21. Based on the results of this evaluation, hydrazine is not identified as a groundwater COPC.

Radium-228. Radium-228 was analyzed for and detected in groundwater samples collected from 1993 to 2006. Although the maximum detected concentration of radium-228 was greater than its action level of 5 pCi/L at two wells, radium-228 was not detected during other sampling rounds at the same locations. Additionally, radium-228 is not identified as a vadose zone soil target analyte and is not identified as a contaminant of concern in DOE/RL-2007-21. Based on the results of this evaluation, radium-228 is not identified as a groundwater COPC.

Sulfide. Sulfide was analyzed for and detected in groundwater samples collected from 1992 through 1994. Although the maximum detected concentration of sulfide was greater than its action level, this constituent is not known to be persistent in the environment. Sulfide is not identified as a target analyte for vadose zone soil and is not identified as a contaminant of concern in DOE/RL-2007-21. Based on the results of this evaluation, sulfide is not identified as a groundwater COPC.

Phosphorus. Phosphorus was analyzed for and detected in groundwater samples collected from 1994 through 2006. However, this is likely a reporting error and may actually represent phosphate results. Phosphorus is not known to be persistent in the environment. Phosphorus is not identified as a potential target analyte for vadose zone soil and is not identified as a contaminant of concern in DOE/RL-2007-21. Based on the results of this evaluation, phosphorus is not identified as a groundwater COPC.

Aluminum and Iron. Aluminum and iron were analyzed for and detected in groundwater samples collected from 1992 to 2009. Although maximum detected concentrations of aluminum and iron are greater than their action levels, which are secondary MCLs, the presence of these metals likely are naturally occurring. Aluminum and iron are not identified as target analytes for vadose zone soil and are not identified as contaminants of concern in DOE/RL-2007-21. Based on the results of this evaluation, aluminum and iron are not identified as COPCs.

D2.6 Results

D2.6.1 Summary of Final COPCs

Table D2-7 identifies the COPCs for 100-F groundwater, proposed analytical methods, their contract required detection limits, action levels, and action level basis.

Thirty-nine analytes have been identified as COPCs for groundwater at the 100-F. This list reflects the analytes most likely to contribute to overall risk within the 100-F. The groundwater data set represents a comprehensive data set for defining the COPCs as it includes groundwater data collected between 1992 and 2009. The groundwater COPCs have been compared to the target analytes identified for vadose zone soil in the 100-F and to the groundwater contaminants of concern identified in DOE/RL-2007-21.

A selection process for target analytes in vadose zone soil has been conducted in coordination with this process for selecting COPCs in groundwater. The target analytes identified for vadose zone soil is based on an approach that was developed during the 100-D/H systematic planning effort by Uncertainty Team No. 1 with participation from the Washington Department of Ecology, Fluor Hanford, and Washington Closure Hanford. The target analytes selection process relies on the review of remediation and characterization information (historic and current) and the identification of appropriate information sources, such as limited field investigation reports, interim action records of decision, cleanup verification documents (Cleanup Verification Packages and Remaining Sites Verification Packages).

DOE/RL-2007-21, Volume 2 includes a baseline risk assessment for each of the groundwater operable units in the 100 Area and 300 Area. The results of this risk assessment identified several uncertainties associated with the groundwater data set. DOE/RL-2007-21, Volume 2 is currently a draft document. Strontium-90, technetium-99, and tritium are identified as COPCs for the 100-FR-3 Groundwater Operable Unit. This draft report also includes several analytes as uncertainties (including bis[2-ethylhexyl] phthalate, carbon-14, cobalt, and uranium-235) because a conclusion about COPC status was considered unsupportable and the data were suspect and inadequate to support risk assessment calculations.

Strontium-90 and tritium are identified as COPCs because groundwater concentrations are measured above their respective action levels of 8 pCi/L and 20,000 pCi/L.

Technetium-99 is not identified as a COPC because groundwater concentrations and MDLs were consistently below the action level of 900 pCi/L.

Uranium-235 is not identified as a COPC for groundwater because there no action level and additionally it was not measured at concentrations above the proposed MCL of 20 pCi/L. Additionally, uranium metal is not identified as a groundwater COPC, as it was not measured at a concentrations above the action level of 30 μg/L.

D2.7 References

Atomic Energy Act of 1954, 42 USC 2011, et seq. Available at: http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0980/ml022200075-vol1.pdf.

Clean Water Act of 1977, 33 USC 1251, et seq. Available at: http://epw.senate.gov/water.pdf. (Note: see *Federal Water Pollution Control Act of 1972*. Available at: http://www.epa.gov/history/topics/fwpca/index.htm.)

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq. Available at: http://uscode.house.gov/download/pls/42C103.txt. Accessed 01/05/10.

DOE/RL-95-99, 1995, *100-FR-3 Groundwater/Soil Gas Supplemental Limited Field Investigation Report*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D197187444.

DOE/RL-2007-21, 2007, *Risk Assessment Report for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment*, Draft A, U.S. Department of Energy, Richland Operations, Richland, Washington. Available at:
http://www5.hanford.gov/arpir/?content=findpage&AKey=0811240459.
http://www5.hanford.gov/arpir/?content=findpage&AKey=0811240460.
http://www5.hanford.gov/arpir/?content=findpage&AKey=0811240461.

Hanford Environmental Information System, Hanford Site database, Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: http://www.epa.gov/epawaste/inforesources/online/index.htm.

Safe Drinking Water Act of 1974, 42 USC 300, et seq. Available at: http://www.epa.gov/ogwdw/sdwa/.

SW-846, 2007, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*, as amended, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: www.epa.gov/SW-846/main.htm.

WHC-SD-EN-RA-012, 1994, *Qualitative Risk Assessment for the 100-FR-3 Groundwater Operable Unit*, Rev.0, Westinghouse Hanford Company, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=D196084470.

WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A.

WAC 173-340-720, "Model Toxics Control Act--Cleanup," "Ground Water Cleanup Standards," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-720.

WAC 173-340-730, "Model Toxics Control Act--Cleanup," "Surface Water Cleanup Standards," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-730.

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Table D2-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-F

CAS NO.	Analyte Name	Analyte Class	Units	Regional Screening Values - Residential Tap Water	Federal MCL or MCLG	WAC 173-201A	Freshwater CCC	Human Health Water + Organism	WAC 173-340-720(4)	WAC 173-340-730(3)	Action Level	Action Level Basis
7429-90-5	Aluminum	METAL	ug/L	3.70E+04	5.00E+01	--	8.70E+01	--	1.60E+04	--	5.00E+01	Federal MCL
7440-36-0	Antimony	METAL	ug/L	1.50E+01	6.00E+00	--	--	5.60E+00	6.40E+00	1.04E+03	5.60E+00	Human Health Water + Organism
7440-38-2	Arsenic	METAL	ug/L	4.50E-02	1.00E+01	1.90E+02	1.50E+02	1.80E-02	5.83E-02	9.82E-02	1.80E-02	Human Health Water + Organism
7440-39-3	Barium	METAL	ug/L	7.30E+03	2.00E+03	--	--	1.00E+03	3.20E+03	--	1.00E+03	Human Health Water + Organism
7440-41-7	Beryllium	METAL	ug/L	7.30E+01	4.00E+00	--	--	--	3.20E+01	2.73E+02	4.00E+00	Federal MCL
7440-69-9	Bismuth	METAL	ug/L	--	--	--	--	--	--	--	--	--
7440-42-8	Boron	METAL	ug/L	7.30E+03	--	--	--	--	3.20E+03	--	3.20E+03	WAC 173-340-720(4)
7440-43-9	Cadmium	METAL	ug/L	1.80E+01	5.00E+00	--	2.50E-01	--	8.00E+00	2.03E+01	2.50E-01	Freshwater CCC
7440-70-2	Calcium	METAL	--	--	--	--	--	--	--	--	--	--
7440-47-3	Chromium	METAL	ug/L	5.50E+04	1.00E+02	--	7.40E+01	--	2.40E+04	2.43E+05	7.40E+01	Freshwater CCC
7440-48-4	Cobalt	METAL	ug/L	1.10E+01	--	--	--	--	4.80E+00	--	4.80E+00	WAC 173-340-720(4)
7440-50-8	Copper	METAL	ug/L	1.50E+03	1.30E+03	--	9.00E+00	1.30E+03	6.40E+02	2.88E+03	9.00E+00	Freshwater CCC
18540-29-9	Hexavalent Chromium	METAL	ug/L	1.10E+02	--	1.00E+01	1.10E+01	--	4.80E+01	4.86E+02	1.00E+01	WAC 173-201A
7439-89-6	Iron	METAL	ug/L	2.60E+04	3.00E+02	--	1.00E+03	3.00E+02	1.12E+04	--	3.00E+02	Federal MCL
7439-92-1	Lead	METAL	ug/L	--	1.50E+01	--	2.50E+00	--	--	--	2.50E+00	Freshwater CCC
7439-93-2	Lithium	METAL	ug/L	7.30E+01	--	--	--	--	3.20E+01	--	3.20E+01	WAC 173-340-720(4)
7439-95-4	Magnesium	METAL	--	--	--	--	--	--	--	--	--	--
7439-96-5	Manganese	METAL	ug/L	8.80E+02	5.00E+01	--	--	5.00E+01	7.52E+02	--	5.00E+01	Federal MCL
7439-97-6	Mercury	METAL	ug/L	6.30E-01	2.00E+00	1.20E-02	--	--	4.80E+00	--	1.20E-02	WAC 173-201A
7439-98-7	Molybdenum	METAL	ug/L	1.80E+02	--	--	--	--	8.00E+01	--	8.00E+01	WAC 173-340-720(4)
7440-02-0	Nickel	METAL	ug/L	7.30E+02	--	--	5.20E+01	6.10E+02	3.20E+02	1.10E+03	5.20E+01	Freshwater CCC
7440-09-7	Potassium	METAL	--	--	--	--	--	--	--	--	--	--
7782-49-2	Selenium	METAL	ug/L	1.80E+02	5.00E+01	5.00E+00	5.00E+00	1.70E+02	8.00E+01	2.70E+03	5.00E+00	Freshwater CCC
7440-21-3	Silicon	METAL	--	--	--	--	--	--	--	--	--	--
7440-22-4	Silver	METAL	ug/L	1.80E+02	1.00E+02	--	--	--	8.00E+01	2.59E+04	8.00E+01	WAC 173-340-720(4)
7440-23-5	Sodium	METAL	--	--	--	--	--	--	--	--	--	--
7440-24-6	Strontium	METAL	ug/L	2.20E+04	--	--	--	--	9.60E+03	--	9.60E+03	WAC 173-340-720(4)
7440-28-0	Thallium	METAL	ug/L	2.40E+00	2.00E+00	--	--	2.40E-01	1.12E+00	1.56E+00	2.40E-01	Human Health Water + Organism
7440-31-5	Tin	METAL	ug/L	2.20E+04	--	--	--	--	9.60E+03	--	9.60E+03	WAC 173-340-720(4)
7440-32-6	Titanium	METAL	ug/L	--	--	--	--	--	6.40E+04	--	6.40E+04	WAC 173-340-720(4)
7440-61-1	Uranium	METAL	ug/L	1.10E+02	3.00E+01	--	--	--	4.80E+01	--	3.00E+01	Federal MCL
7440-62-2	Vanadium	METAL	ug/L	2.60E+02	--	--	--	--	1.12E+02	--	1.12E+02	WAC 173-340-720(4)
7440-66-6	Zinc	METAL	ug/L	1.10E+04	5.00E+03	--	1.20E+02	7.40E+03	4.80E+03	1.65E+04	1.20E+02	Freshwater CCC
12674-11-2	Aroclor-1016	PCB	ug/L	9.60E-01	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
11104-28-2	Aroclor-1221	PCB	ug/L	6.80E-03	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
11141-16-5	Aroclor-1232	PCB	ug/L	6.80E-03	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
53469-21-9	Aroclor-1242	PCB	ug/L	3.40E-02	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
12672-29-6	Aroclor-1248	PCB	ug/L	3.40E-02	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
11097-69-1	Aroclor-1254	PCB	ug/L	3.40E-02	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
11096-82-5	Aroclor-1260	PCB	ug/L	3.40E-02	--	1.40E-02	1.40E-02	6.40E-05	4.38E-02	1.04E-04	6.40E-05	Human Health Water + Organism
72-54-8	4,4'-DDD (Dichlorodiphenyldichloroethane)	PEST	ug/L	2.80E-01	--	--	--	3.10E-04	3.65E-01	5.04E-04	3.10E-04	Human Health Water + Organism
72-55-9	4,4'-DDE (Dichlorodiphenyldichloroethylene)	PEST	ug/L	2.00E-01	--	--	--	2.20E-04	2.57E-01	3.56E-04	2.20E-04	Human Health Water + Organism
50-29-3	4,4'-DDT (Dichlorodiphenyltrichloroethane)	PEST	ug/L	2.00E-01	--	1.00E-03	1.00E-03	2.20E-04	2.57E-01	3.56E-04	2.20E-04	Human Health Water + Organism
309-00-2	Aldrin	PEST	ug/L	4.00E-03	--	1.90E-03	--	4.90E-05	2.57E-03	8.16E-05	4.90E-05	Human Health Water + Organism
319-84-6	Alpha-BHC	PEST	ug/L	1.10E-02	--	--	--	2.60E-03	1.39E-02	7.91E-03	2.60E-03	Human Health Water + Organism
5103-71-9	Alpha-Chlordane	PEST	ug/L	--	--	--	4.30E-03	8.00E-04	2.50E-01	1.31E-03	8.00E-04	Human Health Water + Organism
319-85-7	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	PEST	ug/L	3.70E-02	--	--	--	9.10E-03	4.86E-02	2.77E-02	9.10E-03	Human Health Water + Organism
319-86-8	Delta-BHC	PEST	--	--	--	--	--	--	--	--	--	--
60-57-1	Dieldrin	PEST	ug/L	4.20E-03	--	1.90E-03	5.60E-02	5.20E-05	5.47E-03	8.67E-05	5.20E-05	Human Health Water + Organism
959-98-8	Endosulfan I	PEST	ug/L	--	--	--	5.60E-02	6.20E+01	9.60E+01	5.76E+01	5.60E-02	Freshwater CCC
33213-65-9	Endosulfan II	PEST	ug/L	--	--	--	5.60E-02	6.20E+01	9.60E+01	5.76E+01	5.60E-02	Freshwater CCC
1031-07-8	Endosulfan sulfate	PEST	ug/L	--	--	--	--	6.20E+01	--	--	6.20E+01	Human Health Water + Organism
72-20-8	Endrin	PEST	ug/L	1.10E+01	2.00E+00	2.30E-03	3.60E-02	5.90E-02	4.80E+00	1.96E-01	2.30E-03	WAC 173-201A
7421-93-4	Endrin aldehyde	PEST	ug/L	--	--	--	--	2.90E-01	--	--	2.90E-01	Human Health Water + Organism
53494-70-5	Endrin ketone	PEST	--	--	--	--	--	--	--	--	--	--
58-89-9	Gamma-BHC (Lindane)	PEST	ug/L	6.10E-02	2.00E-01	8.00E-02	--	9.80E-01	6.73E-02	3.84E-02	3.84E-02	WAC 173-340-730(3)
76-44-8	Heptachlor	PEST	ug/L	1.50E-02	4.00E-01	3.80E-03	3.80E-03	7.90E-05	1.94E-02	1.29E-04	7.90E-05	Human Health Water + Organism
1024-57-3	Heptachlor epoxide	PEST	ug/L	7.40E-03	2.00E-01	--	3.80E-03	3.90E-05	4.81E-03	6.36E-05	3.90E-05	Human Health Water + Organism

Table D2-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-F

CAS NO.	Analyte Name	Analyte Class	Units	Regional Screening Values - Residential Tap Water	Federal MCL or MCLG	WAC 173-201A	Freshwater CCC	Human Health Water + Organism	WAC 173-340-720(4)	WAC 173-340-730(3)	Action Level	Action Level Basis
72-43-5	Methoxychlor	PEST	ug/L	1.80E+02	4.00E+01	--	3.00E-02	1.00E+02	8.00E+01	8.36E+00	3.00E-02	Freshwater CCC
8001-35-2	Toxaphene	PEST	ug/L	6.10E-02	3.00E+00	2.00E-04	2.00E-04	2.80E-04	7.95E-02	4.50E-04	2.00E-04	Freshwater CCC
5103-74-2	trans-Chlordane	PEST	ug/L	--	--	--	4.30E-03	8.00E-04	2.50E-01	1.31E-03	8.00E-04	Human Health Water + Organism
14596-10-2	Americium-241	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
14234-35-6	Antimony-125	RAD	pCi/L	--	3.00E+02	--	--	--	--	--	3.00E+02	Federal MCL
14798-08-4	Barium-140	RAD	--	--	--	--	--	--	--	--	--	--
13966-02-4	Beryllium-7	RAD	--	--	--	--	--	--	--	--	--	--
14762-75-5	Carbon-14	RAD	pCi/L	--	2.00E+03	--	--	--	--	--	2.00E+03	Federal MCL
13967-74-3	Cerium-141	RAD	--	--	--	--	--	--	--	--	--	--
14762-78-8	Cerium-144	RAD	pCi/L	--	3.00E+01	--	--	--	--	--	3.00E+01	Federal MCL
13967-70-9	Cesium-134	RAD	pCi/L	--	8.00E+01	--	--	--	--	--	8.00E+01	Federal MCL
10045-97-3	Cesium-137	RAD	pCi/L	--	2.00E+02	--	--	--	--	--	2.00E+02	Federal MCL
14392-02-0	Chromium-51	RAD	--	--	--	--	--	--	--	--	--	--
13981-38-9	Cobalt-58	RAD	--	--	--	--	--	--	--	--	--	--
10198-40-0	Cobalt-60	RAD	pCi/L	--	1.00E+02	--	--	--	--	--	1.00E+02	Federal MCL
14683-23-9	Europium-152	RAD	pCi/L	--	2.00E+02	--	--	--	--	--	2.00E+02	Federal MCL
15585-10-1	Europium-154	RAD	pCi/L	--	6.00E+01	--	--	--	--	--	6.00E+01	Federal MCL
14391-16-3	Europium-155	RAD	pCi/L	--	6.00E+02	--	--	--	--	--	6.00E+02	Federal MCL
12587-46-1	Gross alpha	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
12587-47-2	Gross beta	RAD	--	--	--	--	--	--	--	--	--	--
15046-84-1	Iodine-129	RAD	pCi/L	--	1.00E+00	--	--	--	--	--	1.00E+00	Federal MCL
10043-66-0	Iodine-131	RAD	--	--	--	--	--	--	--	--	--	--
14596-12-4	Iron-59	RAD	--	--	--	--	--	--	--	--	--	--
13966-31-9	Manganese-54	RAD	pCi/L	--	3.00E+02	--	--	--	--	--	3.00E+02	Federal MCL
14681-63-1	Niobium-94	RAD	pCi/L	--	--	--	--	--	--	--	--	--
13981-16-3	Plutonium-238	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
15117-48-3	Plutonium-239	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
PU-239/240	Plutonium-239/240	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
13966-00-2	Potassium-40	RAD	--	--	--	--	--	--	--	--	--	--
15623-45-7	Radium-223	RAD	--	--	--	--	--	--	--	--	--	--
13233-32-4	Radium-224	RAD	--	--	--	--	--	--	--	--	--	--
13982-63-3	Radium-226	RAD	pCi/L	--	5.00E+00	--	--	--	--	--	5.00E+00	Federal MCL
15262-20-1	Radium-228	RAD	pCi/L	--	5.00E+00	--	--	--	--	--	5.00E+00	Federal MCL
13968-53-1	Ruthenium-103	RAD	--	--	--	--	--	--	--	--	--	--
13967-48-1	Ruthenium-106	RAD	pCi/L	--	3.00E+01	--	--	--	--	--	3.00E+01	Federal MCL
13966-32-0	Sodium-22	RAD	pCi/L	--	4.00E+02	--	--	--	--	--	4.00E+02	Federal MCL
10098-97-2	Strontium-90	RAD	pCi/L	--	8.00E+00	--	--	--	--	--	8.00E+00	Federal MCL
14133-76-7	Technetium-99	RAD	pCi/L	--	9.00E+02	--	--	--	--	--	9.00E+02	Federal MCL
14274-82-9	Thorium-228	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
14269-63-7	Thorium-230	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	--	Federal MCL
TH-232	Thorium-232	RAD	pCi/L	--	1.50E+01	--	--	--	--	--	1.50E+01	Federal MCL
15065-10-8	Thorium-234	RAD	--	--	--	--	--	--	--	--	--	--
13966-06-8	Tin-113	RAD	--	--	--	--	--	--	--	--	--	--
10028-17-8	Tritium	RAD	pCi/L	--	2.00E+04	--	--	--	--	--	2.00E+04	Federal MCL
U-233/234	Uranium-233/234	RAD	--	--	--	--	--	--	--	--	--	--
13966-29-5	Uranium-234	RAD	--	--	--	--	--	--	--	--	--	--
15117-96-1	Uranium-235	RAD	--	--	--	--	--	--	--	--	--	--
U-238	Uranium-238	RAD	--	--	--	--	--	--	--	--	--	--
13982-39-3	Zinc-65	RAD	pCi/L	--	3.00E+02	--	--	--	--	--	3.00E+02	Federal MCL
13967-71-0	Zirconium-95	RAD	--	--	--	--	--	--	--	--	--	--
51-28-5	2,4-Dinitrophenol	SVOA	ug/L	7.30E+01	--	--	--	6.90E+01	3.20E+01	3.46E+03	3.20E+01	WAC 173-340-720(4)
117-81-7	Bis(2-ethylhexyl) phthalate	SVOC	ug/L	4.80E+00	6.00E+00	--	--	1.20E+00	6.25E+00	3.56E+00	1.20E+00	Human Health Water + Organism
120-82-1	1,2,4-Trichlorobenzene	SVOC	ug/L	8.20E+00	7.00E+01	--	--	3.50E+01	8.00E+01	2.27E+02	3.50E+01	Human Health Water + Organism
106-46-7	1,4-Dichlorobenzene	SVOC	ug/L	4.30E-01	7.50E+01	--	--	6.30E+01	1.82E+00	4.86E+00	1.82E+00	WAC 173-340-720(4)
872-50-4	1-Methyl-2-pyrrolidinone	SVOC	--	--	--	--	--	--	--	--	--	--
95-95-4	2,4,5-Trichlorophenol	SVOC	ug/L	3.70E+03	--	--	--	1.80E+03	8.00E+02	--	8.00E+02	WAC 173-340-720(4)
88-06-2	2,4,6-Trichlorophenol	SVOC	ug/L	6.10E+00	--	--	--	1.40E+00	3.98E+00	3.93E+00	1.40E+00	Human Health Water + Organism
120-83-2	2,4-Dichlorophenol	SVOC	ug/L	1.10E+02	--	--	--	7.70E+01	4.80E+01	1.91E+02	4.80E+01	WAC 173-340-720(4)

Table D2-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-F

CAS NO.	Analyte Name	Analyte Class	Units	Regional Screening Values - Residential Tap Water	Federal MCL or MCLG	WAC 173-201A	Freshwater CCC	Human Health Water + Organism	WAC 173-340-720(4)	WAC 173-340-730(3)	Action Level	Action Level Basis
105-67-9	2,4-Dimethylphenol	SVOC	ug/L	7.30E+02	--	--	--	3.80E+02	3.20E+02	5.53E+02	3.20E+02	WAC 173-340-720(4)
121-14-2	2,4-Dinitrotoluene	SVOC	ug/L	7.30E+01	--	--	--	1.10E-01	3.20E+01	1.36E+03	1.10E-01	Human Health Water + Organism
606-20-2	2,6-Dinitrotoluene	SVOC	ug/L	3.70E+01	--	--	--	--	1.60E+01	--	1.60E+01	WAC 173-340-720(4)
91-58-7	2-Chloronaphthalene	SVOC	ug/L	2.90E+03	--	--	--	1.00E+03	1.28E+03	1.03E+03	1.00E+03	Human Health Water + Organism
95-57-8	2-Chlorophenol	SVOC	ug/L	1.80E+02	--	--	--	8.10E+01	4.00E+01	9.67E+01	4.00E+01	WAC 173-340-720(4)
91-57-6	2-Methylnaphthalene	SVOC	ug/L	1.50E+02	--	--	--	--	3.20E+01	--	3.20E+01	WAC 173-340-720(4)
95-48-7	2-Methylphenol (cresol, o-)	SVOC	ug/L	1.80E+03	--	--	--	--	4.00E+02	--	4.00E+02	WAC 173-340-720(4)
88-74-4	2-Nitroaniline	SVOC	ug/L	--	--	--	--	--	2.40E+01	--	2.40E+01	WAC 173-340-720(4)
88-75-5	2-Nitrophenol	SVOC	--	--	--	--	--	--	--	--	--	--
91-94-1	3,3'-Dichlorobenzidine	SVOC	ug/L	1.50E-01	--	--	--	2.10E-02	1.94E-01	4.62E-02	2.10E-02	Human Health Water + Organism
65794-96-9	3+4 Methylphenol (cresol, m+p)	SVOC	--	--	--	--	--	--	--	--	--	--
99-09-2	3-Nitroaniline	SVOC	ug/L	3.20E+00	--	--	--	--	2.08E+00	--	2.08E+00	WAC 173-340-720(4)
534-52-1	4,6-Dinitro-2-methylphenol	SVOC	ug/L	3.70E+00	--	--	--	1.30E+01	1.60E+00	--	1.60E+00	WAC 173-340-720(4)
101-55-3	4-Bromophenylphenyl ether	SVOC	--	--	--	--	--	--	--	--	--	--
59-50-7	4-Chloro-3-methylphenol	SVOC	ug/L	--	--	--	--	--	8.00E+02	--	8.00E+02	WAC 173-340-720(4)
106-47-8	4-Chloroaniline	SVOC	ug/L	1.20E+00	--	--	--	--	6.40E+01	--	6.40E+01	WAC 173-340-720(4)
7005-72-3	4-Chlorophenylphenyl ether	SVOC	--	--	--	--	--	--	--	--	--	--
106-44-5	4-Methylphenol (cresol, p-)	SVOC	ug/L	1.80E+02	--	--	--	--	4.00E+01	--	4.00E+01	WAC 173-340-720(4)
100-01-6	4-Nitroaniline	SVOC	ug/L	3.20E+00	--	--	--	--	2.08E+00	--	2.08E+00	WAC 173-340-720(4)
100-02-7	4-Nitrophenol	SVOC	ug/L	--	--	--	--	--	1.28E+02	6.27E+03	1.28E+02	WAC 173-340-720(4)
83-32-9	Acenaphthene	SVOC	ug/L	2.20E+03	--	--	--	6.70E+02	9.60E+02	6.43E+02	6.43E+02	WAC 173-340-730(3)
208-96-8	Acenaphthylene	SVOC	ug/L	--	--	--	--	--	9.60E+02	6.43E+02	6.43E+02	WAC 173-340-730(3)
120-12-7	Anthracene	SVOC	ug/L	1.10E+04	--	--	--	8.30E+03	2.40E+03	2.59E+04	2.40E+03	WAC 173-340-720(4)
56-55-3	Benzo(a)anthracene	SVOC	ug/L	2.90E-02	--	--	--	3.80E-03	1.20E-01	2.96E-01	3.80E-03	Human Health Water + Organism
50-32-8	Benzo(a)pyrene	SVOC	ug/L	2.90E-03	2.00E-01	--	--	3.80E-03	1.20E-02	2.96E-02	3.80E-03	Human Health Water + Organism
205-99-2	Benzo(b)fluoranthene	SVOC	ug/L	2.90E-02	--	--	--	3.80E-03	1.20E-01	2.96E-01	3.80E-03	Human Health Water + Organism
191-24-2	Benzo(ghi)perylene	SVOC	ug/L	--	--	--	--	--	4.80E+02	--	4.80E+02	WAC 173-340-720(4)
207-08-9	Benzo(k)fluoranthene	SVOC	ug/L	2.90E-01	--	--	--	3.80E-03	8.75E-01	2.16E+00	3.80E-03	Human Health Water + Organism
100-51-6	Benzyl alcohol	SVOC	ug/L	1.80E+04	--	--	--	--	4.80E+03	--	4.80E+03	WAC 173-340-720(4)
108-60-1	Bis(2-chloro-1-methylethyl)ether	SVOC	ug/L	3.20E-01	--	--	--	1.40E+03	1.25E+00	3.75E+01	1.25E+00	WAC 173-340-720(4)
111-91-1	Bis(2-Chloroethoxy)methane	SVOC	ug/L	1.10E+02	--	--	--	--	3.98E-02	8.54E-01	3.98E-02	WAC 173-340-720(4)
111-44-4	Bis(2-chloroethyl) ether	SVOC	ug/L	1.20E-02	--	--	--	3.00E-02	3.98E-02	8.54E-01	3.00E-02	Human Health Water + Organism
85-68-7	Butylbenzylphthalate	SVOC	ug/L	3.50E+01	--	--	--	1.50E+03	3.20E+03	1.25E+03	1.25E+03	WAC 173-340-730(3)
86-74-8	Carbazole	SVOC	ug/L	--	--	--	--	--	4.38E+00	--	4.38E+00	WAC 173-340-720(4)
218-01-9	Chrysene	SVOC	ug/L	2.90E+00	--	--	--	3.80E-03	8.75E+00	2.16E+01	3.80E-03	Human Health Water + Organism
53-70-3	Dibenz[a,h]anthracene	SVOC	ug/L	2.90E-03	--	--	--	3.80E-03	8.75E-01	2.16E+00	3.80E-03	Human Health Water + Organism
132-64-9	Dibenzofuran	SVOC	ug/L	--	--	--	--	--	3.20E+01	--	3.20E+01	WAC 173-340-720(4)
84-66-2	Diethylphthalate	SVOC	ug/L	2.90E+04	--	--	--	1.70E+04	1.28E+04	2.84E+04	1.28E+04	WAC 173-340-720(4)
131-11-3	Dimethyl phthalate	SVOC	ug/L	--	--	--	--	2.70E+05	1.60E+04	7.20E+04	1.60E+04	WAC 173-340-720(4)
84-74-2	Di-n-butylphthalate	SVOC	ug/L	3.70E+03	--	--	--	2.00E+03	1.60E+03	2.91E+03	1.60E+03	WAC 173-340-720(4)
117-84-0	Di-n-octylphthalate	SVOC	ug/L	--	--	--	--	--	3.20E+02	--	3.20E+02	WAC 173-340-720(4)
206-44-0	Fluoranthene	SVOC	ug/L	1.50E+03	--	--	--	1.30E+02	6.40E+02	9.02E+01	9.02E+01	WAC 173-340-730(3)
86-73-7	Fluorene	SVOC	ug/L	1.50E+03	--	--	--	1.10E+03	6.40E+02	3.46E+03	6.40E+02	WAC 173-340-720(4)
118-74-1	Hexachlorobenzene	SVOC	ug/L	4.20E-02	1.00E+00	--	--	2.80E-04	5.47E-02	4.66E-04	2.80E-04	Human Health Water + Organism
87-68-3	Hexachlorobutadiene	SVOC	ug/L	8.60E-01	--	--	--	4.40E-01	5.61E-01	2.99E+01	4.40E-01	Human Health Water + Organism
77-47-4	Hexachlorocyclopentadiene	SVOC	ug/L	2.20E+02	5.00E+01	--	--	4.00E+01	9.60E+01	3.58E+03	4.00E+01	Human Health Water + Organism
67-72-1	Hexachloroethane	SVOC	ug/L	4.80E+00	--	--	--	1.40E+00	3.13E+00	5.33E+00	1.40E+00	Human Health Water + Organism
193-39-5	Indeno(1,2,3-cd)pyrene	SVOC	ug/L	2.90E-02	--	--	--	3.80E-03	1.20E-01	2.96E-01	3.80E-03	Human Health Water + Organism
91-20-3	Naphthalene	SVOC	ug/L	1.40E-01	--	--	--	--	1.60E+02	4.94E+03	1.60E+02	WAC 173-340-720(4)
98-95-3	Nitrobenzene	SVOC	ug/L	3.40E+00	--	--	--	1.70E+01	1.60E+01	1.79E+03	1.60E+01	WAC 173-340-720(4)
621-64-7	n-Nitrosodi-n-dipropylamine	SVOC	ug/L	9.60E-03	--	--	--	5.00E-03	1.25E-02	8.19E-01	5.00E-03	Human Health Water + Organism
86-30-6	n-Nitrosodiphenylamine	SVOC	ug/L	1.40E+01	--	--	--	3.30E+00	1.79E+01	9.73E+00	3.30E+00	Human Health Water + Organism
87-86-5	Pentachlorophenol	SVOC	ug/L	5.60E-01	1.00E+00	--	1.50E+01	2.70E-01	7.29E-01	4.91E+00	2.70E-01	Human Health Water + Organism
85-01-8	Phenanthrene	SVOC	ug/L	--	--	--	--	--	2.40E+03	2.59E+04	2.40E+03	WAC 173-340-720(4)
108-95-2	Phenol	SVOC	ug/L	1.10E+04	--	--	--	2.10E+04	2.40E+03	5.56E+05	2.40E+03	WAC 173-340-720(4)
129-00-0	Pyrene	SVOC	ug/L	1.10E+03	--	--	--	8.30E+02	4.80E+02	2.59E+03	4.80E+02	WAC 173-340-720(4)
67-66-3	Chloroform	VOC	ug/L	1.90E-01	7.00E+01	--	--	5.70E+00	7.17E+00	2.83E+02	5.70E+00	Human Health Water + Organism
75-09-2	Methylene chloride	VOC	ug/L	4.80E+00	5.00E+00	--	--	4.60E+00	5.83E+00	9.60E+02	4.60E+00	Human Health Water + Organism

Table D2-1. Summary of Federal and State Water Quality Criteria and Action Levels for the 100-F

CAS NO.	Analyte Name	Analyte Class	Units	Regional Screening Values - Residential Tap Water	Federal MCL or MCLG	WAC 173-201A	Freshwater CCC	Human Health Water + Organism	WAC 173-340-720(4)	WAC 173-340-730(3)	Action Level	Action Level Basis
71-55-6	1,1,1-Trichloroethane	VOC	ug/L	9.10E+03	2.00E+02	--	--	--	1.60E+04	9.26E+05	2.00E+02	Federal MCL
79-34-5	1,1,2,2-Tetrachloroethane	VOC	ug/L	6.70E-02	--	--	--	1.70E-01	2.19E-01	6.48E+00	1.70E-01	Human Health Water + Organism
79-00-5	1,1,2-Trichloroethane	VOC	ug/L	2.40E-01	5.00E+00	--	--	5.90E-01	7.68E-01	2.53E+01	5.90E-01	Human Health Water + Organism
75-34-3	1,1-Dichloroethane	VOC	ug/L	2.40E+00	--	--	--	5.50E-01	8.00E+02	--	5.50E-01	Human Health Water + Organism
75-35-4	1,1-Dichloroethene	VOC	ug/L	3.40E+02	7.00E+00	--	--	3.30E+02	7.29E-02	1.93E+00	7.29E-02	WAC 173-340-720(4)
95-50-1	1,2-Dichlorobenzene	VOC	ug/L	3.70E+02	6.00E+02	--	--	4.20E+02	7.20E+02	4.20E+03	4.20E+02	Human Health Water + Organism
107-06-2	1,2-Dichloroethane	VOC	ug/L	1.50E-01	5.00E+00	--	--	3.80E-01	4.81E-01	5.94E+01	3.80E-01	Human Health Water + Organism
540-59-0	1,2-Dichloroethene (Total)	VOC	ug/L	3.30E+02	--	--	--	--	7.20E+01	--	7.20E+01	WAC 173-340-720(4)
78-87-5	1,2-Dichloropropane	VOC	ug/L	3.90E-01	5.00E+00	--	--	5.00E-01	6.43E-01	2.32E+01	5.00E-01	Human Health Water + Organism
541-73-1	1,3-Dichlorobenzene	VOC	ug/L	--	--	--	--	3.20E+02	2.40E+02	1.40E+03	2.40E+02	WAC 173-340-720(4)
123-91-1	1,4-Dioxane	VOC	ug/L	6.10E+00	--	--	--	--	3.98E+00	--	3.98E+00	WAC 173-340-720(4)
71-36-3	1-Butanol	VOC	ug/L	3.70E+03	--	--	--	--	8.00E+02	--	8.00E+02	WAC 173-340-720(4)
78-93-3	2-Butanone	VOC	ug/L	7.10E+03	--	--	--	--	4.80E+03	--	4.80E+03	WAC 173-340-720(4)
110-75-8	2-Chloroethyl vinyl ether	VOC	--	--	--	--	--	--	--	--	--	--
591-78-6	2-Hexanone	VOC	ug/L	--	--	--	--	--	6.40E+02	--	6.40E+02	WAC 173-340-720(4)
108-10-1	2-Pentanone, 4-Methyl	VOC	ug/L	2.00E+03	--	--	--	--	6.40E+02	--	6.40E+02	WAC 173-340-720(4)
67-64-1	Acetone	VOC	ug/L	2.20E+04	--	--	--	--	7.20E+03	--	7.20E+03	WAC 173-340-720(4)
71-43-2	Benzene	VOC	ug/L	4.10E-01	5.00E+00	--	--	2.20E+00	7.95E-01	2.27E+01	7.95E-01	WAC 173-340-720(4)
65-85-0	Benzoic acid	VOC	ug/L	1.50E+05	--	--	--	--	6.40E+04	--	6.40E+04	WAC 173-340-720(4)
314-40-9	Bromacil (ACN)	VOC	--	--	--	--	--	--	--	--	--	--
75-27-4	Bromodichloromethane	VOC	ug/L	1.10E+00	--	--	--	5.50E-01	7.06E-01	2.79E+01	5.50E-01	Human Health Water + Organism
75-25-2	Bromoform	VOC	ug/L	8.50E+00	--	--	--	4.30E+00	5.54E+00	2.19E+02	4.30E+00	Human Health Water + Organism
74-83-9	Bromomethane	VOC	ug/L	8.70E+00	--	--	--	4.70E+01	1.12E+01	9.68E+02	1.12E+01	WAC 173-340-720(4)
75-15-0	Carbon disulfide	VOC	ug/L	1.00E+03	--	--	--	--	8.00E+02	--	8.00E+02	WAC 173-340-720(4)
56-23-5	Carbon tetrachloride	VOC	ug/L	2.00E-01	5.00E+00	--	--	2.30E-01	3.37E-01	2.66E+00	2.30E-01	Human Health Water + Organism
108-90-7	Chlorobenzene	VOC	ug/L	9.10E+01	1.00E+02	--	--	1.30E+02	1.60E+02	5.03E+03	1.30E+02	Human Health Water + Organism
75-00-3	Chloroethane	VOC	ug/L	2.10E+04	--	--	--	--	--	--	2.10E+04	Regional Screening Values
74-87-3	Chloromethane	VOC	ug/L	1.80E+00	--	--	--	--	3.37E+00	1.33E+02	3.37E+00	WAC 173-340-720(4)
156-59-2	cis-1,2-Dichloroethylene	VOC	ug/L	3.70E+02	7.00E+01	--	--	--	8.00E+01	--	7.00E+01	Federal MCL
10061-01-5	cis-1,3-Dichloropropene	VOC	ug/L	4.30E-01	--	--	--	3.40E-01	2.43E-01	1.89E+01	2.43E-01	WAC 173-340-720(4)
124-48-1	Dibromochloromethane	VOC	ug/L	8.00E-01	--	--	--	4.00E-01	5.21E-01	2.06E+01	4.00E-01	Human Health Water + Organism
107-12-0	Ethyl cyanide	VOC	--	--	--	--	--	--	--	--	--	--
100-41-4	Ethylbenzene	VOC	ug/L	1.50E+00	7.00E+02	--	--	5.30E+02	8.00E+02	6.91E+03	5.30E+02	Human Health Water + Organism
78-59-1	Isophorone	VOC	ug/L	7.10E+01	--	--	--	3.50E+01	4.61E+01	1.56E+03	3.50E+01	Human Health Water + Organism
100-42-5	Styrene	VOC	ug/L	1.60E+03	1.00E+02	--	--	--	1.46E+00	--	1.46E+00	WAC 173-340-720(4)
127-18-4	Tetrachloroethene	VOC	ug/L	1.10E-01	5.00E+00	--	--	6.90E-01	8.10E-02	3.92E-01	8.10E-02	WAC 173-340-720(4)
109-99-9	Tetrahydrofuran	VOC	--	--	--	--	--	--	--	--	--	--
108-88-3	Toluene	VOC	ug/L	2.30E+03	1.00E+03	--	--	1.30E+03	6.40E+02	1.94E+04	6.40E+02	WAC 173-340-720(4)
156-60-5	trans-1,2-Dichloroethylene	VOC	ug/L	1.10E+02	1.00E+02	--	--	1.40E+02	1.60E+02	3.28E+04	1.00E+02	Federal MCL
10061-02-6	trans-1,3-Dichloropropene	VOC	ug/L	4.30E-01	--	--	--	3.40E-01	2.43E-01	1.89E+01	2.43E-01	WAC 173-340-720(4)
79-01-6	Trichloroethene	VOC	ug/L	1.70E+00	5.00E+00	--	--	2.50E+00	4.92E-01	6.87E+00	4.92E-01	WAC 173-340-720(4)
108-05-4	Vinyl acetate	VOC	ug/L	4.10E+02	--	--	--	--	8.00E+03	--	8.00E+03	WAC 173-340-720(4)
75-01-4	Vinyl chloride	VOC	ug/L	1.60E-02	2.00E+00	--	--	2.50E-02	2.92E-02	3.69E+00	2.50E-02	Human Health Water + Organism
1330-20-7	Xylenes (total)	VOC	ug/L	2.00E+02	1.00E+04	--	--	--	1.60E+03	--	1.60E+03	WAC 173-340-720(4)
ALKALINITY	Alkalinity	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
7664-41-7	Ammonia	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
24959-67-9	Bromide	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
COD	Chemical Oxygen Demand	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
DO	Dissolved oxygen	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
EH	Oxidation Reduction Potential	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
PH	pH Measurement	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
CONDUCT	Specific Conductance	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
TEMPERATURE	Temperature	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
TDS	Total dissolved solids	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
TOC	Total organic carbon	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
59473-04-0	Total organic halides	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
TURBIDITY	Turbidity	WATER QUALITY	--	--	--	--	--	--	--	--	--	--
16887-00-6	Chloride	WET CHEM	ug/L	--	2.50E+05	--	2.30E+05	--	--	--	2.30E+05	Freshwater CCC

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CAS NO.	Analyte Name	Analyte Class	Units	Regional Screening Values - Residential Tap Water	Federal MCL or MCLG	WAC 173-201A	Freshwater CCC	Human Health Water + Organism	WAC 173-340-720(4)	WAC 173-340-730(3)	Action Level	Action Level Basis
57-12-5	Cyanide	WET CHEM	ug/L	7.30E+02	2.00E+02	5.20E+00	5.20E+00	1.40E+02	3.20E+02	5.19E+04	5.20E+00	Freshwater CCC
16984-48-8	Fluoride	WET CHEM	ug/L	2.20E+03	4.00E+03	--	--	--	9.60E+02	--	9.60E+02	WAC 173-340-720(4)
302-01-2	Hydrazine	WET CHEM	ug/L	2.20E-02	--	--	--	--	1.46E-02	--	1.46E-02	WAC 173-340-720(4)
7778-77-0	Monopotassium phosphate	WET CHEM	--	--	--	--	--	--	--	--	--	--
14797-55-8	Nitrate (ASN)	WET CHEM	ug/L	5.80E+04	1.00E+04	--	--	--	2.56E+04	--	1.00E+04	Federal MCL
14797-65-0	Nitrite (ASN)	WET CHEM	ug/L	3.70E+03	1.00E+03	--	--	--	1.60E+03	--	1.00E+03	Federal MCL
NO2+NO3-N	Nitrogen in Nitrite and Nitrate	WET CHEM	--	--	--	--	--	--	--	--	--	--
ORGANIC BR	Organic bromide	WET CHEM	--	--	--	--	--	--	--	--	--	--
ORGANIC CL	Organic chloride	WET CHEM	--	--	--	--	--	--	--	--	--	--
ORGANIC I	Organic iodide	WET CHEM	--	--	--	--	--	--	--	--	--	--
14265-44-2	Phosphate	WET CHEM	--	--	--	--	--	--	--	--	--	--
7723-14-0	Phosphorus	WET CHEM	ug/L	7.30E-01	--	--	--	--	3.20E-01	--	3.20E-01	WAC 173-340-720(4)
14808-79-8	Sulfate	WET CHEM	ug/L	--	2.50E+05	--	--	--	--	--	2.50E+05	Federal MCL
18496-25-8	Sulfide	WET CHEM	ug/L	--	--	--	2.00E+00	0.00E+00	--	--	2.00E+00	Freshwater CCC

WAC 173-201A, "Water Quality Standards for Surface Wates of the State of Washington."
WAC 173-340-720(3), "Method A Cleanup Levels for Potable Ground Water."
WAC 173-340-720(4), "Method B Cleanup Levels for Potable Ground Water."
WAC 173-340-730(3), "Method B Surface Water Cleanup Levels."
BHC = hexachlorocyclohexane
CAS = Chemical Abstracts Service
CCC = criteria continuous concentration
MCL = maximum contaminant level
PCB = polychlorinated biphenyls
PEST = pesticides
RAD = radiological
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound
WAC = Washington Administrative Code
WET CHEM = wet chemistry

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Table D2-2. Summary of Groundwater Monitoring Wells in the 100-FR-3 Operable Unit

Monitoring Wells			
199-F1-2	199-F5-44	199-F5-6	199-F8-2
199-F5-1	199-F5-45	199-F6-1	199-F8-3
199-F5-3	199-F5-46	199-F7-1	199-F8-4
199-F5-4	199-F5-47	199-F7-2	199-F8-7
199-F5-42	199-F5-48	199-F7-3	699-77-36
199-F5-43A			

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Table D2-3. Summary of Groundwater Analytes that Meet Exclusion Criteria for the 100-F Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	Basis for Exclusion
Bismuth	METAL	10/13/2005	2/8/2006	3	0	0.00%	ug/L	6.1	6.5	--	--	No toxicity information
Calcium	METAL	12/14/1992	2/3/2009	221	220	99.55%	ug/L	90	90	20,300	182,000	Essential Nutrient
Magnesium	METAL	12/14/1992	2/3/2009	221	220	99.55%	ug/L	159	159	3,620	45,400	Essential Nutrient
Potassium	METAL	12/14/1992	2/3/2009	221	205	92.76%	ug/L	1,000	5,590	1,030	10,700	Essential Nutrient
Silicon	METAL	10/13/2005	2/8/2006	3	3	100.00%	ug/L	--	--	10,200	19,700	No toxicity information
Sodium	METAL	12/14/1992	2/3/2009	221	220	99.55%	ug/L	152	152	2,110	84,900	Essential Nutrient
Delta-BHC	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.048	0.051	--	--	No toxicity information
Endrin ketone	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.050	0.10	--	--	No toxicity information
Antimony-125	RAD	2/11/1992	2/8/2006	18	2	11.11%	pCi/L	-5.97E+00	2.6	5.2	9.4	Half-Life less than 3 years
Barium-140	RAD	3/31/1993	10/31/1993	4	0	0.00%	pCi/L	-6.60E+00	9.5	--	--	Half-Life less than 3 years
Beryllium-7	RAD	3/31/1993	2/8/2006	17	0	0.00%	pCi/L	-2.83E+01	36	--	--	Half-Life less than 3 years
Cerium-141	RAD	3/31/1993	10/31/1993	4	0	0.00%	pCi/L	-6.90E+00	6.2	--	--	Half-Life less than 3 years
Cerium-144	RAD	12/14/1992	5/18/1994	40	0	0.00%	pCi/L	-2.50E+01	80	--	--	Half-Life less than 3 years
Cesium-134	RAD	12/14/1992	2/8/2006	66	0	0.00%	pCi/L	-7.10E+00	20	--	--	Half-Life less than 3 years
Chromium-51	RAD	12/14/1992	4/12/1993	38	0	0.00%	pCi/L	70	1,000	--	--	Half-Life less than 3 years
Cobalt-58	RAD	12/14/1992	6/6/1994	34	0	0.00%	pCi/L	-4.50E+00	20	--	--	Half-Life less than 3 years
Gross beta	RAD	12/14/1992	11/6/2008	285	284	99.65%	pCi/L	1.1	18	2.7	918	Use as an indicator parameter to confirm current concentrations do not exceed 4 mrem/yr standard
Iodine-131	RAD	3/31/1993	10/31/1993	4	0	0.00%	pCi/L	2.0	87	--	--	Half-Life less than 3 years
Iron-59	RAD	12/14/1992	6/6/1994	69	0	0.00%	pCi/L	-1.21E+01	100	--	--	Half-Life less than 3 years
Manganese-54	RAD	3/31/1993	5/18/1994	16	0	0.00%	pCi/L	0	20	--	--	Half-Life less than 3 years
Niobium-94	RAD	10/28/1993	5/18/1994	13	0	0.00%	pCi/L	6.0	10	--	--	No action level
Potassium-40	RAD	12/14/1992	2/8/2006	66	3	4.55%	pCi/L	-1.10E+02	400	55	104	Background Radiation
Radium-223	RAD	12/14/1992	1/8/1993	2	0	0.00%	pCi/L	83	431	--	--	Half-Life less than 3 years
Radium-224	RAD	1/8/1993	1/8/1993	1	0	0.00%	pCi/L	7,700	7,700	--	--	Half-Life less than 3 years
Radium-226	RAD	12/14/1992	2/8/2006	55	2	3.64%	pCi/L	-3.90E+01	50	17	23	Background Radiation
Ruthenium-103	RAD	3/31/1993	5/18/1994	16	0	0.00%	pCi/L	-5.20E+00	30	--	--	Half-Life less than 3 years
Ruthenium-106	RAD	2/11/1992	2/8/2006	75	2	2.67%	pCi/L	-2.20E+01	200	3.0	28	Half-Life less than 3 years
Sodium-22	RAD	10/28/1993	5/18/1994	13	0	0.00%	pCi/L	6.0	40	--	--	Half-Life less than 3 years
Thorium-228	RAD	12/14/1992	2/8/2006	55	1	1.82%	pCi/L	-5.40E-02	40	9.4	9.4	Background Radiation
Thorium-232	RAD	12/14/1992	2/8/2006	54	0	0.00%	pCi/L	0	90	--	--	Background Radiation
Thorium-234	RAD	3/31/1993	10/31/1993	4	0	0.00%	pCi/L	-1.20E+02	-4.20E+00	--	--	No action level
Tin-113	RAD	10/28/1993	5/18/1994	13	0	0.00%	pCi/L	8.0	20	--	--	Half-Life less than 3 years
Uranium-233/234	RAD	12/14/1992	2/8/2006	58	57	98.28%	pCi/L	0.097	0.097	0.17	9.3	No action level
Uranium-234	RAD	5/6/1994	5/28/1998	22	17	77.27%	pCi/L	0.28	0.50	0.30	9.7	No action level
Uranium-235	RAD	12/14/1992	2/8/2006	79	31	39.24%	pCi/L	-4.41E-02	5.1	0.018	0.60	No action level
Uranium-238	RAD	12/14/1992	2/8/2006	79	73	92.41%	pCi/L	0.085	0.48	0.16	11	No action level
Zinc-65	RAD	12/14/1992	10/31/1993	40	0	0.00%	pCi/L	-4.80E+00	50	--	--	Half-Life less than 3 years
Zirconium-95	RAD	3/31/1993	10/31/1993	4	0	0.00%	pCi/L	-3.00E+00	4.2	--	--	Half-Life less than 3 years
1-Methyl-2-pyrrolidinone	SVOC	4/7/1993	4/7/1993	1	1	100.00%	ug/L	--	--	190	190	No toxicity information
2-Nitrophenol	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	--	--	No toxicity information
3+4 Methylphenol (cresol, m+p)	SVOC	10/13/2005	2/8/2006	3	0	0.00%	ug/L	10	10	--	--	No toxicity information
4-Bromophenylphenyl ether	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	--	--	No toxicity information
4-Chlorophenylphenyl ether	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	--	--	No toxicity information
Bis(2-ethylhexyl) phthalate	SVOC	12/14/1992	2/8/2006	98	27	0.28	ug/L	10	10	0.64	140	Common laboratory contaminant
2-Chloroethyl vinyl ether	VOC	4/6/1993	4/6/1993	2	0	0.00%	ug/L	10	10	--	--	No toxicity information
Acetone	VOC	12/14/1992	2/3/2009	283	39	13.78%	ug/L	0.21	16	0.30	27	Common laboratory contaminant
Bromacil (ACN)	VOC	5/9/1994	5/23/1994	2	2	100.00%	ug/L	--	--	26	49	No toxicity information
Ethyl cyanide	VOC	9/12/1997	2/3/2009	130	0	0.00%	ug/L	0.68	2.6	--	--	No toxicity information

Table D2-3. Summary of Groundwater Analytes that Meet Exclusion Criteria for the 100-F Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	Basis for Exclusion
Methylene chloride	VOC	2/11/1992	2/3/2009	304	40	0.13	ug/L	0.097	27	0.19	16	Common laboratory contaminant
Tetrahydrofuran	VOC	1/21/1999	2/3/2009	92	0	0.00%	ug/L	1.2	2.9	--	--	No toxicity information
Alkalinity	WATER QUALITY	12/14/1992	2/3/2009	199	199	100.00%	ug/L	--	--	58,000	513,000	Water Quality
Ammonia	WATER QUALITY	12/14/1992	6/6/1994	95	20	21.05%	ug/L	50	100	50	1,350	No toxicity information
Bromide	WATER QUALITY	2/11/1992	2/8/2006	30	11	36.67%	ug/L	23	250	23	510	No toxicity information
Chemical Oxygen Demand	WATER QUALITY	12/14/1992	6/6/1994	88	19	21.59%	ug/L	1,000	150,000	1,000	14,000	Water Quality
Dissolved oxygen	WATER QUALITY	5/16/1995	10/26/2004	58	58	100.00%	ug/L	--	--	150	82,700	Water Quality
Oxidation Reduction Potential	WATER QUALITY	10/12/2000	10/16/2001	14	14	100.00%	ug/L	--	--	44	299	Water Quality
pH Measurement	WATER QUALITY	2/11/1992	2/3/2009	445	445	100.00%	ug/L	--	--	4.9	10.0	Water Quality
Specific Conductance	WATER QUALITY	2/11/1992	2/3/2009	445	445	100.00%	ug/L	--	--	7.6	1,427	Water Quality
Temperature	WATER QUALITY	2/11/1992	2/3/2009	444	444	100.00%	ug/L	--	--	10	29	Water Quality
Total dissolved solids	WATER QUALITY	12/14/1992	6/6/1994	93	93	100.00%	ug/L	--	--	94,000	811,000	Water Quality
Total organic carbon	WATER QUALITY	12/14/1992	6/6/1994	93	63	67.74%	ug/L	500	1,000	710	5,000	Water Quality
Total organic halides	WATER QUALITY	12/14/1992	6/6/1994	57	25	43.86%	ug/L	0.010	20	5.5	48	Water Quality
Turbidity	WATER QUALITY	7/17/1993	2/3/2009	358	358	100.00%	ug/L	--	--	0	1,000	Water Quality
Monopotassium phosphate	WATER QUALITY	5/18/1995	5/23/1995	2	0	0.00%	ug/L	100	1,000	--	--	No toxicity information
Nitrogen in Nitrite and Nitrate	WATER QUALITY	12/14/1992	2/8/2006	85	82	96.47%	ug/L	250	250	210	28,400	No toxicity information
Organic bromide	WATER QUALITY	7/20/1993	11/6/1993	30	9	30.00%	ug/L	10	10	10	60	No toxicity information
Organic chloride	WATER QUALITY	7/20/1993	11/6/1993	30	0	0.00%	ug/L	10	10	--	--	No toxicity information
Organic iodide	WATER QUALITY	7/20/1993	11/6/1993	30	1	3.33%	ug/L	10	10	10	10	No toxicity information
Phosphate	WATER QUALITY	2/11/1992	2/8/2006	94	2	2.13%	ug/L	20	2,000	92	400	No toxicity information

BHC = hexachlorocyclohexane
PEST = pesticides
RAD = radiological
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound

Table D2-4. Summary of Groundwater Analytes that Were Not Detected for the 100-F Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Action Level	Action Level Basis	Level of Exceedence
Titanium	METAL	5/6/1994	5/6/1994	1	0	0.00%	ug/L	3.0	3.0	64,000	WAC 173-340-720(4)	4.69E-05
Aroclor-1016	PCB	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.40	1.0	6.40E-05	Human Health Water + Organism	6,250
Aroclor-1221	PCB	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.40	2.0	6.40E-05	Human Health Water + Organism	6,250
Aroclor-1232	PCB	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.40	1.0	6.40E-05	Human Health Water + Organism	6,250
Aroclor-1242	PCB	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.40	1.0	6.40E-05	Human Health Water + Organism	6,250
Aroclor-1248	PCB	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.40	1.0	6.40E-05	Human Health Water + Organism	6,250
Aroclor-1254	PCB	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.40	1.0	6.40E-05	Human Health Water + Organism	6,250
Aroclor-1260	PCB	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.40	1.0	6.40E-05	Human Health Water + Organism	6,250
4,4'-DDD (Dichlorodiphenyldichloroethane)	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.050	0.10	3.10E-04	Human Health Water + Organism	161
4,4'-DDE (Dichlorodiphenyldichloroethylene)	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.050	5.0	2.20E-04	Human Health Water + Organism	227
4,4'-DDT (Dichlorodiphenyltrichloroethane)	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.050	0.10	2.20E-04	Human Health Water + Organism	227
Aldrin	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.048	0.051	4.90E-05	Human Health Water + Organism	980
Alpha-BHC	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.048	0.051	0.0026	Human Health Water + Organism	18
Alpha-Chlordane	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.050	5.0	8.00E-04	Human Health Water + Organism	63
beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.048	0.051	0.0091	Human Health Water + Organism	5.3
Dieldrin	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.050	0.10	5.20E-05	Human Health Water + Organism	962
Endosulfan I	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.048	5.0	0.056	Freshwater CCC	0.86
Endosulfan II	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.050	0.10	0.056	Freshwater CCC	0.89
Endosulfan sulfate	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.050	0.10	62	Human Health Water + Organism	8.06E-04
Endrin	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.050	0.10	0.036	Freshwater CCC	1.4
Gamma-BHC (Lindane)	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.048	0.051	0.038	173-340-730(3)	1.3
Methoxychlor	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.050	0.50	0.030	Freshwater CCC	1.7
Toxaphene	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.051	5.0	2.00E-04	Freshwater CCC	255
trans-Chlordane	PEST	12/14/1992	2/8/2006	99	0	0.00%	ug/L	0.050	5.0	8.00E-04	Human Health Water + Organism	63
Europium-152	RAD	12/14/1992	2/8/2006	75	0	0.00%	pCi/L	-2.20E+01	40	200	Federal MCL	-1.10E-01
Europium-155	RAD	12/14/1992	2/8/2006	49	0	0.00%	pCi/L	-4.00E+01	40	600	Federal MCL	-6.67E-02
Plutonium-239	RAD	3/31/1993	10/26/1993	3	0	0.00%	ug/L	-9.80E-02	0.030	15	Federal MCL	-6.53E-03
Thorium-230	RAD	10/13/2005	2/8/2006	3	0	0.00%	pCi/L	-4.00E-02	0	15	Federal MCL	-2.67E-03
2,4-Dinitrophenol	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	25	50	32	WAC 173-340-720(4)	0.78
1,2,4-Trichlorobenzene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	35	Human Health Water + Organism	0.29
2,4,5-Trichlorophenol	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	25	50	800	WAC 173-340-720(4)	0.031
2,4,6-Trichlorophenol	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	1.4	Human Health Water + Organism	7.1
2,4-Dichlorophenol	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	48	WAC 173-340-720(4)	0.21
2,4-Dimethylphenol	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	320	WAC 173-340-720(4)	0.031
2,4-Dinitrotoluene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.11	Human Health Water + Organism	91
2,6-Dinitrotoluene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	16	WAC 173-340-720(4)	0.63
2-Chloronaphthalene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	1,000	Human Health Water + Organism	0.010
2-Chlorophenol	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	40	WAC 173-340-720(4)	0.25
2-Methylnaphthalene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	32	WAC 173-340-720(4)	0.31
2-Methylphenol (cresol, o-)	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	400	WAC 173-340-720(4)	0.025
2-Nitroaniline	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	25	50	24	WAC 173-340-720(4)	1.0
3,3'-Dichlorobenzidine	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	20	0.021	Human Health Water + Organism	476
3-Nitroaniline	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	25	50	2.1	WAC 173-340-720(4)	12
4,6-Dinitro-2-methylphenol	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	25	50	1.6	WAC 173-340-720(4)	16
4-Chloro-3-methylphenol	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	800	WAC 173-340-720(4)	0.013
4-Chloroaniline	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	64	WAC 173-340-720(4)	0.16
4-Methylphenol (cresol, p-)	SVOC	12/14/1992	6/6/1994	95	0	0.00%	ug/L	10	10	40	WAC 173-340-720(4)	0.25
4-Nitroaniline	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	25	50	2.1	WAC 173-340-720(4)	12
4-Nitrophenol	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	25	50	128	WAC 173-340-720(4)	0.20
Acenaphthene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	25	643	173-340-730(3)	0.016

Table D2-4. Summary of Groundwater Analytes that Were Not Detected for the 100-F Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Action Level	Action Level Basis	Level of Exceedence
Acenaphthylene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	643	173-340-730(3)	0.016
Anthracene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	2,400	WAC 173-340-720(4)	0.0042
Benzo(a)anthracene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.0038	Human Health Water + Organism	2,632
Benzo(a)pyrene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.0038	Human Health Water + Organism	2,632
Benzo(b)fluoranthene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.0038	Human Health Water + Organism	2,632
Benzo(ghi)perylene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	480	WAC 173-340-720(4)	0.021
Benzo(k)fluoranthene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.0038	Human Health Water + Organism	2,632
Benzyl alcohol	SVOC	7/19/1993	7/19/1993	1	0	0.00%	ug/L	10	10	4,800	WAC 173-340-720(4)	0.0021
Bis(2-chloro-1-methylethyl)ether	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	1.3	WAC 173-340-720(4)	8.0
Bis(2-Chloroethoxy)methane	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.040	WAC 173-340-720(4)	251
Bis(2-chloroethyl) ether	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.030	Human Health Water + Organism	333
Carbazole	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	4.4	WAC 173-340-720(4)	2.3
Chrysene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.0038	Human Health Water + Organism	2,632
Dibenz[a,h]anthracene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.0038	Human Health Water + Organism	2,632
Dibenzofuran	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	32	WAC 173-340-720(4)	0.31
Dimethyl phthalate	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	16,000	WAC 173-340-720(4)	6.25E-04
Di-n-octylphthalate	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	320	WAC 173-340-720(4)	0.031
Fluoranthene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	90	173-340-730(3)	0.11
Fluorene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	640	WAC 173-340-720(4)	0.016
Hexachlorobenzene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	2.80E-04	Human Health Water + Organism	35,714
Hexachlorobutadiene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.44	Human Health Water + Organism	23
Hexachlorocyclopentadiene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	40	Human Health Water + Organism	0.25
Hexachloroethane	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	1.4	Human Health Water + Organism	7.1
Indeno(1,2,3-cd)pyrene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.0038	Human Health Water + Organism	2,632
Naphthalene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	160	WAC 173-340-720(4)	0.063
Nitrobenzene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	16	WAC 173-340-720(4)	0.63
n-Nitrosodi-n-dipropylamine	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	0.0050	Human Health Water + Organism	2,000
n-Nitrosodiphenylamine	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	3.3	Human Health Water + Organism	3.0
Pentachlorophenol	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	25	50	0.27	Human Health Water + Organism	93
Phenanthrene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	2,400	WAC 173-340-720(4)	0.0042
Pyrene	SVOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	480	WAC 173-340-720(4)	0.021
1,1,2,2-Tetrachloroethane	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	5.0	10	0.17	Human Health Water + Organism	29
1,1,2-Trichloroethane	VOC	12/14/1992	2/3/2009	290	0	0.00%	ug/L	0.047	10	0.59	Human Health Water + Organism	0.080
1,1-Dichloroethane	VOC	2/11/1992	2/3/2009	304	0	0.00%	ug/L	0.070	10	0.55	Human Health Water + Organism	0.13
1,2-Dichlorobenzene	VOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	420	Human Health Water + Organism	0.024
1,2-Dichloroethene (Total)	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	5.0	10	72	WAC 173-340-720(4)	0.069
1,2-Dichloropropane	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	5.0	10	0.50	Human Health Water + Organism	10
1,3-Dichlorobenzene	VOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	240	WAC 173-340-720(4)	0.042
1,4-Dioxane	VOC	10/14/2002	10/17/2006	28	0	0.00%	ug/L	2.6	13	4.0	WAC 173-340-720(4)	0.65
1-Butanol	VOC	9/12/1997	2/3/2009	130	0	0.00%	ug/L	1.1	100	800	WAC 173-340-720(4)	0.0014
Benzoic acid	VOC	7/19/1993	7/19/1993	1	0	0.00%	ug/L	50	50	64,000	WAC 173-340-720(4)	7.81E-04
Bromodichloromethane	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	5.0	10	0.55	Human Health Water + Organism	9.1
Bromoform	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	5.0	10	4.3	Human Health Water + Organism	1.2
Bromomethane	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	10	10	11	WAC 173-340-720(4)	0.89
Chloroethane	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	10	10	21,000	Regional Screening Values	4.76E-04
Chloromethane	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	10	10	3.4	WAC 173-340-720(4)	3.0
cis-1,2-Dichloroethylene	VOC	2/11/1992	2/3/2009	152	0	0.00%	ug/L	0.060	1.0	70	Federal MCL	8.57E-04
cis-1,3-Dichloropropene	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	5.0	10	0.24	WAC 173-340-720(4)	21
Dibromochloromethane	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	5.0	10	0.40	Human Health Water + Organism	13
Ethylbenzene	VOC	2/11/1992	2/3/2009	229	0	0.00%	ug/L	0.066	10	530	Human Health Water + Organism	1.25E-04

Table D2-4. Summary of Groundwater Analytes that Were Not Detected for the 100-F Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Action Level	Action Level Basis	Level of Exceedence
Isophorone	VOC	12/14/1992	2/8/2006	98	0	0.00%	ug/L	10	10	35	Human Health Water + Organism	0.29
Styrene	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	5.0	10	1.5	WAC 173-340-720(4)	3.4
trans-1,2-Dichloroethylene	VOC	2/11/1992	2/3/2009	152	0	0.00%	ug/L	0.050	1.0	100	Federal MCL	5.00E-04
trans-1,3-Dichloropropene	VOC	12/14/1992	10/8/1997	153	0	0.00%	ug/L	5.0	10	0.24	WAC 173-340-720(4)	21
Vinyl acetate	VOC	7/19/1993	7/19/1993	1	0	0.00%	ug/L	10	10	8,000	WAC 173-340-720(4)	0.0013
Vinyl chloride	VOC	12/14/1992	2/3/2009	290	0	0.00%	ug/L	0.070	10	0.025	Human Health Water + Organism	2.8
Cyanide	WET CHEM	12/14/1992	6/6/1994	94	0	0.00%	ug/L	10	20	5.2	Freshwater CCC	1.9

WAC 173-340-720(3), "Method B Cleanup Levels for Potable Ground Water."
WAC 173-340-730(3), "Method B Surface Water Cleanup Levels."
BHC = hexachlorocyclohexane
CCC = criteria continuous concentration
MCL = maximum contaminant level
PCB = polychlorinated biphenyls
PEST = pesticides
RAD = radiological
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound
WAC = Washington Administrative Code
WET CHEM = wet chemistry

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Table D2-5. Summary of Groundwater Analytes that Do Not Exceed an Action Level for the 100-F Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	Action Level	Action Level Basis	Level of Exceedence	COPC?	Basis For Exclusion
Barium	METAL	12/14/1992	2/3/2009	221	220	99.55%	ug/L	4.6	4.6	14	156	1,000	Human Health Water + Organism	0.16	No	Max concentration and MDLs < action level
Boron	METAL	10/13/2005	2/8/2006	3	3	100.00%	ug/L	--	--	27	176	3,200	WAC 173-340-720(4)	0.055	No	Max concentration and MDLs < action level
Lithium	METAL	10/13/2005	2/8/2006	3	3	100.00%	ug/L	--	--	1.9	22	32	WAC 173-340-720(4)	0.69	No	Max concentration < action level
Molybdenum	METAL	10/13/2005	2/8/2006	3	2	66.67%	ug/L	1.8	1.8	1.7	5.5	80	WAC 173-340-720(4)	0.069	No	Max concentration and MDLs < action level
Silver	METAL	12/14/1992	2/3/2009	221	6	2.71%	ug/L	0.80	9.0	4.0	7.9	80	WAC 173-340-720(4)	0.099	No	Max concentration and MDLs < action level
Strontium	METAL	10/8/1997	2/3/2009	70	69	98.57%	ug/L	2.8	2.8	106	1,410	9,600	WAC 173-340-720(4)	0.15	No	Max concentration and MDLs < action level
Tin	METAL	10/13/2005	2/8/2006	3	1	33.33%	ug/L	5.1	5.2	6.0	6.0	9,600	WAC 173-340-720(4)	6.25E-04	No	Max concentration and MDLs < action level
Uranium	METAL	2/11/1992	2/3/2009	80	78	97.50%	ug/L	21	21	0.69	23	30	Federal MCL	0.76	No	Max concentration and MDLs < action level
Vanadium	METAL	12/14/1992	2/3/2009	221	131	59.28%	ug/L	0.90	56	1.2	40	112	WAC 173-340-720(4)	0.35	No	Max concentration and MDLs < action level
Endrin aldehyde	PEST	12/14/1992	2/8/2006	99	1	1.01%	ug/L	0.050	0.10	0.078	0.078	0.29	Human Health Water + Organism	0.27	No	Max concentration and MDLs < action level
Americium-241	RAD	12/14/1992	2/8/2006	77	1	1.30%	pCi/L	-8.29E-02	4.0	0.067	0.067	15	Federal MCL	0.0045	Yes	Insufficient number of analyses
Carbon-14	RAD	12/14/1992	10/15/2002	147	45	30.61%	pCi/L	-8.10E+01	236	3.9	460	2,000	Federal MCL	0.23	Yes	Insufficient number of analyses
Cesium-137	RAD	2/11/1992	2/8/2006	88	4	4.55%	pCi/L	-6.75E+00	20	0.61	7.4	200	Federal MCL	0.037	Yes	Insufficient number of analyses
Cobalt-60	RAD	2/11/1992	2/8/2006	88	3	3.41%	pCi/L	-6.57E+00	30	1.0	3.2	100	Federal MCL	0.032	Yes	Insufficient number of analyses
Europium-154	RAD	12/14/1992	2/8/2006	83	2	2.41%	pCi/L	-1.67E+01	30	3.5	4.1	60	Federal MCL	0.068	Yes	Insufficient number of analyses
Iodine-129	RAD	9/28/1994	10/17/2000	4	1	25.00%	pCi/L	-1.39E-01	0.11	0.14	0.14	1.0	Federal MCL	0.14	Yes	Insufficient number of analyses
Plutonium-238	RAD	12/14/1992	6/6/1994	51	1	1.96%	pCi/L	-3.70E-02	0.087	0.043	0.043	15	Federal MCL	0.0029	Yes	Insufficient number of analyses
Plutonium-239/240	RAD	12/14/1992	6/6/1994	65	1	1.54%	pCi/L	-4.82E-02	4.7	0.040	0.040	15	Federal MCL	0.0027	Yes	Insufficient number of analyses
Technetium-99	RAD	2/11/1992	2/8/2006	89	18	20.22%	pCi/L	-8.34E+00	11	0.016	38	900	Federal MCL	0.042	Yes	Insufficient number of analyses
1,4-Dichlorobenzene	SVOC	12/14/1992	2/3/2009	237	4	1.69%	ug/L	0.090	10	0.21	0.24	1.8	WAC 173-340-720(4)	0.13	No	Max concentration < action level
Butylbenzylphthalate	SVOC	12/14/1992	2/8/2006	98	1	1.02%	ug/L	10	10	2.0	2.0	1,250	WAC 173-340-730(3)	0.0016	No	Max concentration and MDLs < action level
Diethylphthalate	SVOC	12/14/1992	2/8/2006	98	2	2.04%	ug/L	10	10	1.0	16	12,800	WAC 173-340-720(4)	0.0013	No	Max concentration and MDLs < action level
Di-n-butylphthalate	SVOC	12/14/1992	2/8/2006	98	5	5.10%	ug/L	10	10	0.90	4.0	1,600	WAC 173-340-720(4)	0.0025	No	Max concentration and MDLs < action level
Phenol	SVOC	12/14/1992	2/8/2006	98	2	2.04%	ug/L	10	10	1.0	2.0	4,800	WAC 173-340-720(4)	4.17E-04	No	Max concentration and MDLs < action level
1,1,1-Trichloroethane	VOC	2/11/1992	2/3/2009	304	4	1.32%	ug/L	0.070	10	1.0	2.0	200	Federal MCL	0.010	No	Max concentration and MDLs < action level
1,2-Dichloroethane	VOC	2/11/1992	2/3/2009	304	4	1.32%	ug/L	0.080	10	0.083	0.34	0.38	Human Health Water + Organism	0.89	No	Max concentration < action level
2-Butanone	VOC	12/14/1992	2/3/2009	283	7	2.47%	ug/L	0.10	10	0.80	32	4,800	WAC 173-340-720(4)	0.0067	No	Max concentration and MDLs < action level
2-Hexanone	VOC	12/14/1992	10/8/1997	153	2	1.31%	ug/L	10	10	3.0	10	640	WAC 173-340-720(4)	0.016	No	Max concentration and MDLs < action level
2-Pentanone, 4-Methyl	VOC	12/14/1992	2/3/2009	283	4	1.41%	ug/L	0.10	10	2.0	10	640	WAC 173-340-720(4)	0.016	No	Max concentration and MDLs < action level
Carbon disulfide	VOC	12/14/1992	2/3/2009	283	2	0.71%	ug/L	0.060	10	0.42	2.8	800	WAC 173-340-720(4)	0.0035	No	Max concentration and MDLs < action level
Chlorobenzene	VOC	12/14/1992	2/3/2009	168	1	0.60%	ug/L	0.28	10	2.0	2.0	130	Human Health Water + Organism	0.015	No	Max concentration and MDLs < action level
Toluene	VOC	2/11/1992	2/3/2009	304	6	1.97%	ug/L	0.070	10	1.0	4.0	640	WAC 173-340-720(4)	0.0063	No	Max concentration and MDLs < action level
Xylenes (total)	VOC	2/11/1992	2/3/2009	301	5	1.66%	ug/L	0.13	10	1.0	4.0	1,600	WAC 173-340-720(4)	0.0025	No	Max concentration and MDLs < action level
Chloride	WET CHEM	2/11/1992	2/3/2009	386	386	100.00%	ug/L	--	--	740	71,400	230,000	Freshwater CCC	0.31	No	Max concentration and MDLs < action level
Nitrite	WET CHEM	2/11/1992	2/3/2009	235	4	1.70%	ug/L	2.0	250	46	108	1,000	Federal MCL	0.11	No	Max concentration and MDLs < action level

WAC 173-340-720(3), "Method B Cleanup Levels for Potable Ground Water."
WAC 173-340-730(3), "Method B Surface Water Cleanup Levels."
CCC = criteria continuous concentration
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PEST = pesticides
RAD = radiological
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound
WAC = Washington Administrative Code
WET CHEM = wet chemistry

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Table D2-6. Summary of Groundwater Analytes that Exceed an Action Level for the 100-F Operable Unit

Analyte Name	Analyte Class	Begin Sample Date	End Sample Date	Total Samples	Total Detects	Frequency of Detects	Units	Minimum Detection Limit	Maximum Detection Limit	Minimum Detected Result	Maximum Detected Result	Action Level	Action Level Basis	Level of Exceedence	COPC?	Basis For Inclusion
Aluminum	METAL	12/14/1992	2/8/2006	197	70	0.36	ug/L	4.8	125	18	520	50	Federal MCL	10	No	Naturally occuring; not identified as a vadose zone target analyte
Antimony	METAL	12/14/1992	2/3/2009	221	15	0.068	ug/L	2.0	60	3.8	58	5.6	Human Health Water + Organism	10	Yes	Max concentration and MDLs > action level
Arsenic	METAL	12/14/1992	2/8/2006	155	93	0.60	ug/L	0.90	31	0.82	22	0.018	Human Health Water + Organism	1,200	Yes	Max concentration and MDLs > action level
Beryllium	METAL	12/14/1992	2/3/2009	221	12	0.054	ug/L	0.10	4.0	0.20	8.3	4.0	Federal MCL	2.1	Yes	Max concentration and MDLs > action level
Cadmium	METAL	12/14/1992	2/3/2009	221	5	0.023	ug/L	0.24	5.0	1.1	7.4	0.25	Federal MCL	30	Yes	Max concentration and MDLs > action level
Chromium	METAL	12/14/1992	2/3/2009	221	174	0.79	ug/L	0.65	13	2.3	334	74	Freshwater CCC	4.5	Yes	Max concentration and MDLs > action level
Cobalt	METAL	12/14/1992	2/3/2009	221	3	0.014	ug/L	0.70	10	8.0	13	4.8	WAC 173-340-720(4)	2.6	Yes	Max concentration and MDLs > action level
Copper	METAL	12/14/1992	2/3/2009	221	62	0.28	ug/L	0.86	25	1.3	56	9.0	Freshwater CCC	6.2	Yes	Max concentration and MDLs > action level
Hexavalent Chromium	METAL	12/7/1999	2/3/2009	10	8	0.80	ug/L	2.0	2.0	3.0	197	10	WAC 173-201A	20	Yes	Max concentration and MDLs > action level
Iron	METAL	12/14/1992	2/3/2009	221	159	0.72	ug/L	3.7	246	9.2	14,400	300	Federal MCL	48	No	Naturally occuring; not identified as a vadose zone target analyte
Lead	METAL	12/14/1992	2/8/2006	155	56	0.36	ug/L	0.70	23	0.95	18	2.5	Freshwater CCC	7.2	Yes	Max concentration and MDLs > action level
Manganese	METAL	12/14/1992	2/3/2009	221	137	0.62	ug/L	0.50	21	0.25	262	50	Federal MCL	5.2	Yes	Max concentration and MDLs > action level
Mercury	METAL	12/14/1992	2/8/2006	97	1	0.01	ug/L	0.10	0.20	0.20	0.20	0.012	WAC 173-201A	17	Yes	Max concentration and MDLs> action level
Nickel	METAL	12/14/1992	2/3/2009	221	53	0.24	ug/L	1.3	38	2.7	87	52	Freshwater CCC	1.7	Yes	Max concentration and MDLs > action level
Selenium	METAL	12/14/1992	2/8/2006	102	27	0.26	ug/L	2.0	90	2.1	17	5.0	Freshwater CCC	3.3	Yes	Max concentration and MDLs > action level
Thallium	METAL	12/14/1992	2/8/2006	102	12	0.12	ug/L	1.1	500	1.2	4.1	0.24	Human Health Water + Organism	17	Yes	Max concentration and MDLs > action level
Zinc	METAL	12/14/1992	2/3/2009	221	131	0.59	ug/L	1.8	53	1.6	1,080	120	Freshwater CCC	9.0	Yes	Max concentration and MDLs > action level
Heptachlor	PEST	12/14/1992	2/8/2006	99	1	0.010	ug/L	0.048	0.051	0.95	0.95	7.90E-05	Human Health Water + Organism	12,025	No	Anomalous results; not identified as a vadose zone target analyte
Heptachlor epoxide	PEST	12/14/1992	2/8/2006	99	3	0.030	ug/L	0.048	5.0	0.027	0.90	3.90E-05	Human Health Water + Organism	23,077	No	Anamolous results; immobile in soil
Gross alpha	RAD	12/14/1992	11/6/2008	270	200	0.74	pCi/L	-7.80E+00	6.5	0.42	63	15	Federal MCL	4.2	Yes	Indicator parameter
Radium-228	RAD	7/21/1993	2/8/2006	18	2	0.11	pCi/L	-1.36E-01	60	43	81	5.0	Federal MCL	16	No	Anamolous result; not identified as a vadose zone target analyte
Strontium-90	RAD	2/11/1992	2/3/2009	300	164	0.55	pCi/L	-1.41E+00	18	0.034	429	8.0	Federal MCL	54	Yes	Max concentration and MDLs > action level
Tritium	RAD	2/11/1992	2/3/2009	334	240	0.72	pCi/L	-1.90E+02	12,000	27	180,000	20,000	Federal MCL	9.0	Yes	Max concentration and MDLs > action level
1,1-Dichloroethene	VOC	12/14/1992	2/3/2009	176	1	0.0057	ug/L	0.040	10	1.0	1.0	0.073	WAC 173-340-720(4)	14	Yes	Max concentration and MDLs > action level
Benzene	VOC	2/11/1992	2/3/2009	304	1	0.0033	ug/L	0.050	10	2.0	2.0	0.80	WAC 173-340-720(4)	2.5	No	Max concentration and MDLs > action level
Carbon tetrachloride	VOC	2/11/1992	2/3/2009	304	5	0.016	ug/L	0.047	10	0.15	20	0.23	Human Health Water + Organism	87	Yes	Anamolous result; not identified as a vadose zone target analyte
Chloroform	VOC	2/11/1992	2/3/2009	304	100	0.33	ug/L	0.065	10	0.064	10	5.7	Human Health Water + Organism	1.8	Yes	Max concentration and MDLs > action level
Tetrachloroethene	VOC	2/11/1992	2/3/2009	304	3	0.0099	ug/L	0.073	10	0.40	3.6	0.081	WAC 173-340-720(4)	44	Yes	Max concentration and MDLs > action level
Trichloroethene	VOC	2/11/1992	2/3/2009	302	146	0.48	ug/L	0.090	10	0.29	29	0.49	WAC 173-340-720(4)	59	Yes	Max concentration and MDLs > action level
Fluoride	WET CHEM	2/11/1992	2/3/2009	385	349	0.91	ug/L	13	500	18	1,500	960	WAC 173-340-720(4)	1.6	Yes	Max concentration and MDLs > action level
Hydrazine	WET CHEM	3/31/1993	6/3/1994	56	18	0.32	ug/L	1.0	3.0	1.0	20	0.015	WAC 173-340-720(4)	1,370	No	Not known to be persistent in the environment; not a vadose zone target analyte
Nitrate	WET CHEM	2/11/1992	2/3/2009	310	310	1.0	ug/L	--	--	300	1.01E+06	10,000	Federal MCL	101	Yes	Max concentration and MDLs > action level
Phosphorus	WET CHEM	11/9/1994	2/8/2006	4.0	3	0.75	ug/L	50	50	19	27	0.32	Regional Screening Values	84	No	Not known to be persistent in the environment; not a vadose zone target analyte
Sulfate	WET CHEM	2/11/1992	2/3/2009	384	384	1.0	ug/L	--	--	9,250	275,000	250,000	Federal MCL	1.1	Yes	Max concentration and MDLs > action level
Sulfide	WET CHEM	12/14/1992	6/6/1994	85	17	0.20	ug/L	100	1,000	1,000	85,000	2.0	Freshwater CCC	42,500	No	Not known to be persistent in the environment; not a vadose zone target analyte

WAC 173-340-720(3), "Method B Cleanup Levels for Potable Ground Water."
CCC = criteria continuous concentration
MCL = maximum contaminant level
PEST = pesticides
RAD = radiological
VOC = Volatile Organic Compound
WAC = Washington Administrative Code
WET CHEM = wet chemistry

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Table D2-7. Groundwater COPCs and Recommended Analytical Methods for the 100-F

Constituent Name	Constituent Class	Analytical Method	Units	EQL	Action Level	Action Level Basis
Antimony	Metal	Trace – ICP (6010) or ICP/MS (6020 or 200.8)	µg/L	5	5.60	Human Health for the Consumption of Water + Organism[1]
Arsenic	Metal	Trace – ICP (6010) or ICP/MS (6020 or 200.8)	µg/L	4	0.018	Human Health for the Consumption of Water + Organism[1]
Beryllium	Metal	ICP/MS (6020 or 200.8)	µg/L	2	4.0	40 CFR 141.62
Cadmium	Metal	Trace – ICP (6010) or ICP/MS (6020 or 200.8)	µg/L	2	0.25	Freshwater CCC[1]
Chromium	Metal	ICP Metals - 6010	µg/L	10	74	Freshwater CCC[1]
Cobalt	Metal	ICP Metals - 6010	µg/L	4	4.8	WAC 173-340-720(4)(b)(iii)(A) and (B)
Copper	Metal	ICP/MS (6020 or 200.8)	µg/L	8	9	Freshwater CCC[1]
Hexavalent Chromium	Metal	Chromium (hex) - 7196	µg/L	10	10	WAC 173-201A
Lead	Metal	Trace – ICP (6010)	µg/L	2	2.1	WAC 173-201A
Manganese	Metal	ICP Metals - 6010	µg/L	5	50	40 CFR 143.3
Mercury	Metal	Mercury – 7470	µg/L	0.5	0.05	WAC 173-201A
Nickel	Metal	ICP Metals - 6010	µg/L	40	52	Freshwater CCC[1]
Selenium	Metal	Trace – ICP (6010) or ICP/MS (6020 or 200.8)	µg/L	10	5	Freshwater CCC[1]
Thallium	Metal	Trace – ICP (6010) or ICP/MS (6020 or 200.8)	µg/L	2	0.24	Human Health for the Consumption of Water + Organism[1]
Zinc	Metal	ICP Metals - 6010	µg/L	10	91	WAC 173-201A
Americium-241	Radionuclide	Americium-241	pCi/L	1	15	40 CFR 141.66
Carbon-14	Radionuclide	Carbon-14	pCi/L	200	2,000	40 CFR 141.66

Table D2-7. Groundwater COPCs and Recommended Analytical Methods for the 100-F

Constituent Name	Constituent Class	Analytical Method	Units	EQL	Action Level	Action Level Basis
Cesium-137	Radionuclide	Gamma Energy Analysis	pCi/L	15	200	40 CFR 141.66
Cobalt-60	Radionuclide	Gamma Energy Analysis	pCi/L	25	100	40 CFR 141.66
Europium-154	Radionuclide	Gamma Energy Analysis	pCi/L	50	60	40 CFR 141.66
Iodine-129	Radionuclide	Iodine-129 (low-level)	pCi/L	1	1	40 CFR 141.66
Plutonium-238	Radionuclide	Isotopic plutonium	pCi/L	1	15	40 CFR 141.66
Plutonium-239/240	Radionuclide	Isotopic plutonium	pCi/L	1	15	40 CFR 141.66
Strontium-90	Radionuclide	Strontium 89/90 - Sr-90	pCi/L	2	8	40 CFR 141.66
Technetium-99	Radionuclide	Technetium-99	pCi/L	15	900	40 CFR 141.66
Thorium-230	Radionuclide	Isotopic thorium	pCi/L	1	15	40 CFR 141.66
Tritium	Radionuclide	Tritium (H-3)	pCi/L	400	20,000	40 CFR 141.66
1,1-Dichloroethene	Volatile organic compound	Volatile Organics - 8260	µg/L	2	0.073	WAC 173-340-720(4)(b)(iii)(A) and (B)
Carbon Tetrachloride	Volatile organic compound	Volatile Organics - 8260	µg/L	1.0	0.23	Human Health for the Consumption of Water + Organism[1]
Chloroform	Volatile organic compound	Volatile Organics - 8260	µg/L	5	5.7	Human Health for the Consumption of Water + Organism[1]
Styrene	Volatile organic compound	Volatile Organics - 8260	µg/L	5	1.46	WAC 173-340-720(4)(b)(iii)(A) and (B)
Tetrachloroethene	Volatile organic compound	Volatile Organics - 8260	µg/L	5	0.081	WAC 173-340-720(4)(b)(iii)(A) and (B)
Trichloroethene	Volatile organic compound	Volatile Organics - 8260	µg/L	1.0	0.49	WAC 173-340-720(4)(b)(iii)(A) and (B)

Table D2-7. Groundwater COPCs and Recommended Analytical Methods for the 100-F

Constituent Name	Constituent Class	Analytical Method	Units	EQL	Action Level	Action Level Basis
Vinyl Chloride	Volatile organic compound	Volatile Organics - 8260	µg/L	5	0.025	Human Health for the Consumption of Water + Organism[1]
Fluoride	Wet chemistry	Anions by IC - 300.0	µg/L	500	960	WAC 173-340-720(4)(b)(iii)(A) and (B)
Nitrate	Wet chemistry	Anions by IC - 300.0	µg/L	250	10,000	40 CFR 141.62
Sulfate	Wet chemistry	Anions by IC - 300.0	µg/L	500	250,000	40 CFR 143.3

Notes: For four digit EPA methods, see SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B. For EPA Method 200.8, see EPA/600/R-94/111, Methods for the Determination of Metals in Environmental Samples, Supplement 1. For EPA Method 300.0, see EPA/600/4-79/020, Methods of Chemical Analysis of Water and Wastes.

WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington."

National recommended Water Quality Criteria Table (ambient water quality criteria for aquatic life and human health) at www.epa.gov/waterscience/criteria/wqctable/index.html

CCC = criteria continuous concentration
CFR = Code of Federal Regulations
CRDL = Contract Required Detection Level
EPA = Environmental Protection Agency
C = ion chromatography
ICP = inductively coupled plasma
MS = mass spectrometry
WAC = Washington Administrative Code

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D3 100-F Area Target Analyte List Development for Soil

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Rev. 0

STANDARD APPROVAL PAGE

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D3.1 Purpose

This report documents the process used to identify source area target analytes in support of the 100-F Area remedial investigation/feasibility study (RI/FS) addendum to DOE/RL-2008-46, *Integrated 100 Area Remedial Investigation/Feasibility Study (RI/FS) Work Plan.* A "target analyte" is defined as a constituent suspected of being site-related that is carried into an investigation plan for characterization through sampling and analysis by approved laboratory methods. Target analytes identified for 100 and 300 Area must support RI/FS nature and extent characterization plus final remedial action decisions for source areas. This report also establishes the analyte exclusion criteria applicable for 100 and 300 Area use and the analytical methods needed to analyze the master target analytes.

D3.2 Approach

The approach for development of vadose zone soil target analytes is a multi-step process. The first two steps develop an initial and master list of target analytes for the area. The third step is to develop location specific (e.g., waste site) target analyte lists where additional characterization is proposed. Finally, the analyte list will receive regulatory review. During this step, concerns regarding the selection process may result in the addition of analytes by the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology, and the U.S. Department of Energy (commonly called the Tri-Parties).

Step 1 – Prepare Initial Master Target Analyte

Characterization data for vadose zone soils are not available for addressing uncertainties associated with the nature and extent of contamination in the vadose zone. Therefore, remediation and characterization information (historic and current) are identified and reviewed to develop an initial list of target analytes to represent potential contamination in the vadose zone. The following types of reference documents and information sources are evaluated:

- Focused feasibility studies (FFS), limited field investigation (LFI) reports
- Interim action records of decision (IARODs)
- Cleanup verification documents (cleanup verification packages [CVPs], remaining sites verification packages [RSVPs])
- Technical baseline reports
- Dangerous waste permit applications
- Databases containing analytical data resulting from these activities (i.e., characterization, remediation, waste management information)
- Other pertinent documents

Step 2 – Prepare Master Target Analyte List

After the initial target analyte list is compiled, the information undergoes additional review steps to remove analytes using generally accepted exclusion criteria, conduct a comparison of the soil target analyte list to the groundwater COPC list, and identify the appropriate analytical methods and detection limits for the master target analyte list.

At the conclusion of this step, the master target analyte list is established. The master target analyte list is comprehensive and includes all the analytes that have the potential to be present in the vadose zone and are important for waste site remediation within the area. The following steps are taken to prepare the master target analyte list:

- Apply the following generally-accepted exclusion criteria that are listed below to the initial set of target analytes to develop the "master" target analyte list.
  - Radionuclides with a half life of 3 years (and no significant daughters) will be eliminated as COPCs. Radionuclides with short half lives can include antimony 125, beryllium 7, cesium 134, curium 242, radium 224, ruthenium 106, and thorium 228.
  - Naturally occurring radionuclides associated with background radiation (e.g., K 40, Th 230, Th-232, and Ra-226).
  - Essential nutrients are those chemicals considered essential for human nutrition. Recommended daily allowances are developed for essential nutrients to estimate safe and adequate daily dietary intakes (NRC, 1989, Recommended Daily Allowances). The following metals are considered essential nutrients: calcium, magnesium, potassium, and sodium.
  - Analytes that have no toxicity values (based on the hierarchy of toxicity values recommended by the EPA in Human Health Toxicity Values for Superfund Risk Assessments [OSWER Directive 9285.7-53).
- Compare the master target analyte list for vadose zone soil with the groundwater COPC list developed for the area. Groundwater COPCs not found on the master target analyte list are further evaluated to determine if there is a valid basis for their inclusion.
- Identify appropriate analytical methods for each analyte on the master target analyte list. Determine if the detection limits for each target analyte can achieve the remedial action goals for direct exposure, groundwater protection, and Columbia River protection.

Step 3 – Develop Location-Specific Target Analyte List

The master target analyte list represents all potential target analytes that could be present in the vadose zone. Location specific target analytes will be identified from the master list using the following approach.

- Identify the contaminants of concern for the specific waste sites where characterization is proposed from the applicable interim action ROD (which reflects information from LFI and technical baseline reports). If the characterization location is not at a waste site, evaluate information from waste sites in the vicinity (where available). Include these analytes on the location specific target analyte list.
- Identify the contaminants of concern for the specific waste site locations from the verification documentation (CVPs or RSVPs). If the characterization location is not at a waste site, evaluate information from waste sites in the vicinity (where available). Include these analytes on the location-specific target analyte list.
- Evaluate local groundwater monitoring well data (wells located within waste site "zones of influence"). Determine if groundwater COPCs have been analyzed for in these local wells.
  - If the groundwater COPCs have been analyzed for but not detected, then these analytes will not be included on the location-specific target analyte list.
  - If the groundwater COPCs have been analyzed for and have been detected, then these analytes will be included on the location-specific target analyte list.

- If the groundwater COPCs have not been analyzed for, then an additional evaluation will be performed to determine if there is a data need. If there is a data need, these COPCs will be included on the waste-site specific target analyte list.

Step 4 – Agency Review of Locations and Location-Specific Target Analyte Lists

Following development of the master and location-specific target analyte lists via Steps 1, 2, and 3, the regulatory agencies will review the proposed sampling locations and their associated location-specific target analyte lists to determine if adjustments/modifications are required to address additional information needs for the area. When additional information needs are identified, the regulatory agencies will modify the locations and/or the location-specific target analyte lists to reflect the additions/modifications needed for the area.

D3.3 Assumptions

- Historical resources (e.g., LFI, qualitative risk assessment, and CVP/RSVP documents) contain contaminant lists that are comprehensive with respect to characterizing environmental impacts from 100 and 300 Area Hanford Site operations.
- Older analytical data (e.g., pre-Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [CERCLA]) reflect laboratory state-of-the-art procedures. Analytical methods have improved, resulting in lower detection limits for many analytes and better data quality assurance/quality control.
- Characterization activities implemented since initiating remediation under the IARODs may provide additional contaminant information that should be considered during pending RI/FS field investigations.
- Post-remediation characterization and cleanup verification data reflect focused lists of analytes that are unique to each waste site and have been evaluated against IAROD cleanup requirements.
- Examining existing data and waste site process information will be useful in developing laboratory analytical needs for RI/FS characterization tasks.
- Universally-accepted exclusion criteria may be applied to the initial target analyte list to develop a "master" target analyte list.
- Additional exclusion criteria (e.g., statistical Hanford Site background comparisons, infrequently detected analytes, and analytes not detected at concentrations/activities exceeding required cleanup levels) may be applied during the RI/FS process as more data become available.

D3.4 Software Considerations

No statistical or algebraic calculations were performed for this activity. The evaluations conducted included analyte comparisons/sorting using Microsoft® Excel.®

D3.5 Soil Target Analyte List Development

Initial Target Analyte Identification

1. The documents listed in Table D3-1 were used to develop the 100-F target analyte list.

® Microsoft and Excel are registered trademarks of Microsoft Corporation in the United States and/or other countries.

Table D3-1. Documents Used to Develop the 100-F Initial Target Analyte List

Reference	Document Number	Document Type
1. Cleanup Verification Package for the 100-F-2 Strontium Garden	CVP-2001-00001	CVP
2. Cleanup Verification Package for the 100-F-19:1 and 100-F-19:3 Reactor Cooling Water Effluent Pipelines, 100-F-34 Biology Facility French Drain, and 116-F-12 French Drain	CVP-2001-00002	CVP
3. Cleanup Verification Package for the 100-F-19:2 Reactor Cooling Water Effluent Pipelines, 116-F-11 Cushion Corridor French Drain, UPR-100-F-1 Sewer Line Leak, and 100-F-29 Experimental Animal Farm Process Sewer Pipelines	CVP-2001-00003	CVP
4. Cleanup Verification Package for the 116-F-2, 107-F Liquid Waste Disposal Trench	CVP-2001-00005	CVP
5. Cleanup Verification Package for the 116-F-4 Pluto Crib	CVP-2001-00006	CVP
6. Cleanup Verification Package for the 116-F-5 Ball Washer Crib	CVP-2001-00007	CVP
7. Cleanup Verification Package for the 116-F-9 Animal Waste Leaching Trench	CVP-2001-00008	CVP
8. Cleanup Verification Package for the 116-F-14 Retention Basin	CVP-2001-00009	CVP
9. Cleanup Verification Package for the 1607-F6 Septic System and Pipelines	CVP-2001-00010	CVP
10. Cleanup Verification Package for the UPR-100-F-2 Basin Leak Ditch	CVP-2001-00011	CVP
11. Cleanup Verification Package for the 100-F-4, 100-F-11, 100-F-15, and 100-F-16 French Drains	CVP-2002-00001	CVP
12. Cleanup Verification Package for the 126-F-1, 184-F Powerhouse Ash Pit	CVP-2002-00004	CVP
13. Cleanup Verification Package for the 1607-F2 Septic System	CVP-2002-00005	CVP
14. Cleanup Verification Package for the 100-F-35 Soil Contamination Site	CVP-2002-00007	CVP
15. Cleanup Verification Package for the 116-F-3 Fuel Storage Basin Trench	CVP-2002-00008	CVP
16. Cleanup Verification Package for the 116-F-1 Lewis Canal	CVP-2002-00009	CVP
17. Cleanup Verification Package for the 116-F-6 Liquid Waste Disposal Trench	CVP-2002-00010	CVP
18. Cleanup Verification Package for the 116-F-10, 105-F Dummy Decontamination French Drain	CVP-2003-00003	CVP
19. Cleanup Verification Package for the 100-F-25, 146-FR Drywell	CVP-2003-00010	CVP
20. Cleanup Verification Package for the 100-F-23, 141-C Drywell	CVP-2003-00011	CVP
21. Cleanup Verification Package for the 100-F-24, 145-F Drywell	CVP-2003-00012	CVP

Table D3-1. Documents Used to Develop the 100-F Initial Target Analyte List

Reference	Document Number	Document Type
22. Cleanup Verification Package for the 118-F-8:1, 105-F Reactor Below-Grade Structures and Underlying Soils; the 118-F-8:3, 105-F Fuel Storage Basin Underlying Soils; and the 100-F-10 French Drain	CVP-2003-00017	CVP
23. Cleanup Verification Package for the 118-F-7, 100-F Miscellaneous Hardware Storage Vault	CVP-2006-00007	CVP
24. Cleanup Verification Package for the 118-F-3, Minor Construction Burial Ground	CVP-2006-00008	CVP
25. Cleanup Verification Package for the 100-F-20, Pacific Northwest Laboratory Parallel Pit	CVP-2006-00009	CVP
26. Cleanup Verification Package for the 188-F-1 Burial Ground	CVP-2007-00001	CVP
27. Cleanup Verification Package for the 118-F-2 Burial Ground	CVP-2007-00002	CVP
28. Cleanup Verification Package for the 118-F-5 PNL Sawdust Pit	CVP-2007-00003	CVP
29. Cleanup Verification Package for the 118-F-8:4 Fuel Storage Basin West Side Adjacent and Side Slope Soils	CVP-2007-00004	CVP
30. Cleanup Verification Package for the 118-F-6 Burial Ground	CVP-2008-00001	CVP
31. EPA, 1999, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units*	EPA/ROD/R10-99/039	IAROD
32. Waste Site Reclassification Form for 100-F-28, January 2003	WSRF-2001-030	WSRF
33. Waste Site Reclassification Form for 132-F-4, December 2003	WSRF-2003-023	WSRF
34. Waste Site Reclassification Form for132-F-3, December 2003	WSRF-2003-025	WSRF
35. Waste Site Reclassification Form for 132-F-5, December 2003	WSRF-2003-029	WSRF
36. Waste Site Reclassification Form for 132-F-6, December 2003	WSRF-2003-032	WSRF
37. Waste Site Reclassification Form for 128-F-1, December 2003	WSRF-2003-035	WSRF
38. Waste Site Reclassification Form for 100-F-38, March 2006	WSRF-2004-093	WSRF
39. Waste Site Reclassification Form for 100-F-37, August 2004	WSRF-2004-095	WSRF
40. Waste Site Reclassification Form for 100-F-26:3 Pipelines, December 2004	WSRF-2004-118	WSRF
41. Waste Site Reclassification Form for 100-F-26:6 Pipelines, December 2004	WSRF-2004-119	WSRF
42. Waste Site Reclassification Form for 100-F-26:16 Pipelines, November 2005	WSRF-2004-120	WSRF
43. Waste Site Reclassification Form for 100-F-7, February 2005	WSRF-2004-124	WSRF
44. Waste Site Reclassification Form for 100-F-9, February 2005	WSRF-2004-125	WSRF

Table D3-1. Documents Used to Develop the 100-F Initial Target Analyte List

Reference	Document Number	Document Type
45. Waste Site Reclassification Form for 100-F-12, February 2005	WSRF-2004-126	WSRF
46. Waste Site Reclassification Form for 100-F-14, March 2005	WSRF-2004-127	WSRF
47. Waste Site Reclassification Form for 116-F-7:1, February 2005	WSRF-2004-128	WSRF
48. Waste Site Reclassification Form for 118-F-4, February 2005	WSRF-2004-129	WSRF
49. Waste Site Reclassification Form for 1607-F1 January 2008	WSRF-2004-130,	WSRF
50. Waste Site Reclassification Form for 1607-F4, December 2007	WSRF-2004-131	WSRF
51. Waste Site Reclassification Form for 100-F-18, February 2005	WSRF-2004-137	WSRF
52. Waste Site Reclassification Form for 100-F-26:11 Pipelines, May 2005	WSRF-2005-003	WSRF
53. Waste Site Reclassification Form for 100-F-26:2 Pipelines, May 2005	WSRF-2005-005	WSRF
54. Waste Site Reclassification Form for 100-F-26:5 Pipelines, Jul 2005	WSRF-2005-007	WSRF
55. Waste Site Reclassification Form for 100-F-26:1 Pipelines, Jul 2005	WSRF-2005-008	WSRF
56. Waste Site Reclassification Form for 100-F-26:7 Pipelines, Ma 2005	WSRF-2005-010	WSRF
57. Waste Site Reclassification Form for 100-F-26:13 Pipelines, Marc 2008	WSRF-2005-011	WSRF
58. Waste Site Reclassification Form for 182-F, September 2005	WSRF-2005-025	WSRF
59. Waste Site Reclassification Form for 132-F-4:2, November 2005	WSRF-2005-043	WSRF
60. Waste Site Reclassification Form for 116-F-7:2, November 2005	WSRF-2005-044	WSRF
61. Waste Site Reclassification Form for 126-F-2, May 2006	WSRF-2006-017	WSRF
62. Waste Site Reclassification Form for 100-F-33, August 2006	WSRF-2006-021	WSRF
63. Waste Site Reclassification Form for 141-C, May 2006	WSRF-2006-027	WSRF
64. Waste Site Reclassification Form for 132-F-1, August 2006	WSRF-2006-029	WSRF
65. Waste Site Reclassification Form for 100-F-31, August 2006	WSRF-2006-033	WSRF
66. Waste Site Reclassification Form for 116-F-8, September 2006	WSRF-2006-038	WSRF
67. Waste Site Reclassification Form for 116-F-16, September 2006	WSRF-2006-039	WSRF
68. Waste Site Reclassification Form for 1607-F7, October 2006	WSRF-2006-040	WSRF
69. Waste Site Reclassification Form for 128-F-3, October 2006	WSRF-2006-042	WSRF
70. Waste Site Reclassification Form for 1607-F5, September 2006	WSRF-2006-043	WSRF
71. Waste Site Reclassification Form for 1607-F3, April 2007	WSRF-2006-047	WSRF

Table D3-1. Documents Used to Develop the 100-F Initial Target Analyte List

Reference	Document Number	Document Type
72. Waste Site Reclassification Form for 100-F-41, February 2007	WSRF-2006-064	WSRF
73. Waste Site Reclassification Form for 100-F-50, April 2008	WSRF-2007-001	WSRF
74. Waste Site Reclassification Form for 100-F-36, May 2007	WSRF-2007-002	WSRF
75. Waste Site Reclassification Form for 116-F-15, May 2007	WSRF-2007-003	WSRF
76. Waste Site Reclassification Form for 100-F-44:1, April 2007	WSRF-2007-005	WSRF
77. Waste Site Reclassification Form for 100-F-44:6, April 2007	WSRF-2007-007	WSRF
78. Waste Site Reclassification Form for 100-F-44:3, June 2007	WSRF-2007-010	WSRF
79. Waste Site Reclassification Form for 100-F-44:10, October 2007	WSRF-2007-011	WSRF
80. Waste Site Reclassification Form for 100-F-44:7, August 2007	WSRF-2007-012	WSRF
81. Waste Site Reclassification Form for 100-F-26:10 Pipelines, December 2007	WSRF-2007-028	WSRF
82. Waste Site Reclassification Form for 100-F-26:14 Pipelines, February 2008	WSRF-2007-029	WSRF
83. Waste Site Reclassification Form for 100-F-53, June 2009	WSRF-2008-019	WSRF
84. Waste Site Reclassification Form for 120-F-1, May 2008	WSRF-2008-028	WSRF
85. Waste Site Reclassification Form for 128-F-2, June 2008	WSRF-2008-031	WSRF
86. Limited Field Investigation Report for the 100-FR-1 Operable Unit	DOE/RL-93-82	LFI

Note:

CVP = cleanup verification package
FFS = focused feasibility study
IAROD = Interim Action Record of Decision
LFI = limited field investigation
RSVP = remaining sites verification package
WIDS = Waste Information Data System
WSRF = waste site reclassification form

2. The initial list of target analytes presented in Table D3-2 was created from the review and evaluation of the Table 1 documents.

Table D3-2. Summary of 100-F Initial Target Analytes and References

Analyte	Reference	Analyte	Reference
Radionuclides			
1. Americium-241	CVP-2007-00001	12. Potasium-40	DOE/RL-93-82 (LFI)
2. Barium-133	CVP-2003-00017	13. Radium-226	DOE/RL-93-82 (LFI)
3. Carbon-14	CVP-2007-00001	14. Silver-108m	CVP-2007-00001
4. Cesium-137	CVP-2002-00004	15. Strontium-90	CVP-2007-00001
5. Cobalt-60	CVP-2002-00004	16. Technetium-99	CVP-2003-00017
6. Europium-152	CVP-2002-00004	17. Thorium-228	DOE/RL-93-82 (LFI)
7. Europium-154	CVP-2002-00004	18. Thorium-232	DOE/RL-93-82 (LFI)
8. Europium-155	CVP-2002-00004	19. Tritium	CVP-2007-00001
9. Nickel-63	CVP-2007-00001	20. Uranium-233/234	CVP-2003-00017
10. Plutonium-238	CVP-2007-00001	21. Uranium-235	CVP-2003-00017
11. Plutonium-239/240	CVP-2007-00001	22. Uranium-238	CVP-2003-00017
Nonradionuclides			
1. 2-butanone	DOE/RL-93-82 (LFI)	43. Cobalt	CVP-2003-00017
2. 2-hexanone	RSVP-2006-042	44. Copper	DOE/RL-93-82 (LFI)
3. 2-methyl-naphthalene	WSRF-2006-021	45. Dalapon	WSRF-2007-001
4. 4,4'-DDD	RSVP-2006-042	46. Dibenz(a,h)-anthracene	RSVP-2008-028
5. 4,4'-DDE	RSVP-2006-042	47. Dibenzofuran	WSRF-2006-029
6. 4,4'-DDT	RSVP-2006-042	48. Diethyl phthalate	WSRF-2008-031
7. 4-methyl-2-pentanone	DOE/RL-93-82 (LFI)	49. Dimethyl phthalate	WSRF-2008-031
8. Acenaphthene	WSRF-2006-017	50. Di-n-butylphalate	DOE/RL-93-82 (LFI)
9. Acetone	DOE/RL-93-82 (LFI)	51. Endosulfan I	RSVP-2008-028
10. Aldrin	RSVP-2006-042	52. Endosulfan sulfate	RSVP-2006-042
11. Anthracene	RSVP-2008-028	53. Endrin aldehyde	WSRF-2004-131
12. Antimony	RSVP-2008-028	54. Endrin ketone	RSVP-2006-042
13. Aroclor-1016 (PCB)	CVP-2007-00004	55. Ethylbenzene	RSVP-2006-042
14. Aroclor-1221(PCB)	CVP-2007-00004	56. Fluoranthene	DOE/RL-93-82 (LFI)
15. Aroclor-1232(PCB)	CVP-2007-00004	57. Fluorene	WSRF-2006-017
16. Aroclor-1242(PCB)	CVP-2007-00004	58. Fluoride	RSVP-2008-028

Table D3-2. Summary of 100-F Initial Target Analytes and References

Analyte	Reference	Analyte	Reference
17. Aroclor-1248(PCB)	CVP-2007-00004	59. Heptachlor epoxide	RSVP-2006-042
18. Aroclor-1254 (PCB)	CVP-2007-00004	60. Indeno(1,2,3-cd) pyrene	WSRF-2006-017
19. Aroclor-1260 (PCB)	CVP-2007-00004	61. Lead	DOE/RL-93-82 (LFI)
20. Arsenic	DOE/RL-93-82 (LFI)	62. Manganese	CVP-2003-00017
21. Barium	CVP-2003-00017	63. Mercury	WSRF-2006-021
22. Benzo(a) pyrene	CVP-2003-00017	64. Methoxychlor	RSVP-2006-042
23. Benzo(a)anthracene	CVP-2003-00017	65. Methylene chloride	DOE/RL-93-82 (LFI)
24. Benzo(b) fluoranthene	CVP-2003-00017	66. Molybdenum	WSRF-2006-021
25. Benzo(g,h,i)perylene	CVP-2003-00017	67. Napthalene	WSRF-2006-021
26. Benzo(k) fluoranthene	CVP-2003-00017	68. Nickel	CVP-2003-00017
27. Beryllium	CVP-2003-00017	69. Nitrate	WSRF-2008-028
28. BHC-Alpha	WSRF-2008-028	70. Phenanthrene	CVP-2003-00017
29. BHC-Beta	WSRF-2008-028	71. Phenol	WSRF-2006-021
30. Bis(2-ethylhexyl phthalate)	DOE/RL-93-82 (LFI)	72. Pyrene	DOE/RL-93-82 (LFI)
31. Boron	CVP-2003-00017	73. Selenium	WSRF-2006-017
32. Butyl benzyl phthalate	WSRF-2006-040	74. Silver	WSRF-2004-130
33. Cadmium	CVP-2003-00017	75. Styrene	RSVP-2006-042
34. Carbazole	WSRF-2008-031	76. Sulfate	RSVP-2008-028
35. Chlordane- Alpha	RSVP-2008-028	77. Tetrachloroethene	RSVP-2006-042
36. Chlordane-Gamma	RSVP-2008-028	78. Toluene	DOE/RL-93-82 (LFI)
37. Chloride	WSRF-2008-028	79. Total petroleum hydrocarbon	WSRF-2006-017
38. Chlorobenzene	RSVP-2006-042	80. Toxaphene	DOE/RL-93-82 (LFI)
39. Chloroform	RSVP-2006-042	81. Vanadium	CVP-2003-00017
40. Chromium (Hexavalent)	CVP-2003-00017	82. 4Xylene	RSVP-2006-042
41. Chromium (Total)	CVP-2003-00017	83. Zinc	DOE/RL-93-82 (LFI)
42. Chrysene	CVP-2003-00017		

Note: The primary references are listed for each analyte; most analytes were referenced in multiple documents.

CVP = cleanup verification package

COPC = contaminant of potential concern

LFI = limited field investigation

3. The generally accepted exclusion criteria that follow were applied to the initial soil target analyte list to identify the excluded analytes listed in Table D3-3 and to develop the master target analyte list presented in Table D3-4.

- Radionuclides with half-lives less than 3 years (and no significant "daughters")
- Naturally occurring radionuclides associated with background radiation
- Essential nutrients (minerals)
- Analytes that have no toxicity values (per the most current CLARC Table)

Table D3-3. 100-F Initial Soil Analytes Excluded from Further Consideration

Analyte	Exclusion Rationale	Half-life
Radionuclides		
Potasium-40	Naturally-occurring background radiation	1.28 E9 years
Thorium-228	Decay daughter of Th-232/Ra-228; in equilibrium with parent	1.91 years
Radium-226	Only potential source from naturally-occurring background radiation (insufficient in-growth time for Hanford introduced U as decay daughter of U-234/Th-230)	1.6 E3 years
Thorium-232	Naturally-occurring background radiation	1.4 E10 years
Nonradionuclides		
Chloride	Essential nutrient	
Sulfate	Essential nutrient	

Table D3-4. Master 100-F Target Analyte List

Target Analyte	Practical Quantitation Limits (PQLs)	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	
Radionuclides					
1. Cesium-137	0.1	6.2	NV	NV	1. Gamma energy analysis
2. Cobalt-60	0.05	1.4	NV	NV	
3. Europium-152	0.1	3.3	NV	NV	
4. Europium-154	0.1	3.0	NV	NV	
5. Europium-155	0.1	125	NV	NV	
6. Americium-241	1	31.1	NV	NV	
7. Barium-133	0.2	11.8	NV	NV	
8. Silver-108m	0.2	2.38	NV	NV	

Table D3-4. Master 100-F Target Analyte List

Target Analyte	Practical Quantitation Limits (PQLs)	Preliminary Cleanup Goals[a] Direct Exposure	Groundwater Protection	River Protection	Analytical Methods
9. Strontium-90*	1	4.5	NV	NV	2. Gas flow proportional counting
10. Plutonium-238	1	37.4	NV	NV	3. Isotopic - plutonium
11. Plutonium-239/240	1	33.9	NV	NV	
12. Uranium-233/234	1	1.1[b]	1.1[b]	1.1[b]	4. Isotopic - uranium
13. Uranium-235	1	0.61	0.185[d]	0.185[d]	
14. Uranium-238	1	1.1[b]	1.1[b]	1.1[b]	
15. Carbon-14	2	5.16	NV	NV	5. Liquid scintillation counter
16. Nickel-63	30	4,026	NV	NV	
17. Technetium-99	0.25	5.7	0.46	0.46	
18. Tritium*	10	510	15.8	15.8	
Nonradionuclides					
19. Fluoride*	5	4,800	12,000	24,000	6. Anions by IC 300.0
20. Nitrate*	2.5	128,000	40	80	
21. Chromium (hexavalent)*	0.5	240	18.4	7.7	7. Cr VI 7196
22. Antimony*	6	32	5.4	25.3	8. EPA 6010 (ICP metals)
23. Arsenic*	10	20[c]	20[c]	20[c]	
24. Barium	2	16,000	1,650	3,300	
25. Beryllium*	0.5	160	63.2	126	
26. Boron	2	16,000	210	NV	
27. Cadmium*	0.5	80	0.69	0.25[d]	
28. Chromium (total)*	1	120,000	2,000	2,600	
29. Cobalt*	2	24	15.7[d]	NV	
30. Copper*	1	3,200	284	1,150	
31. Lead*	5	250	3,000	840	
32. Manganese*	5	3,760	512[c]	512[c]	
33. Molybdenum	2	400	32.3	NV	
34. Nickel*	4	1,600	130	357	
35. Selenium*	10	400	5.2[d]	1.04[d]	
36. Silver	1	400	13.6	0.884	
37. *Thallium (GW COPC)*	5	5.6	1.59	4.46	
38. Vanadium	2.5	560	2,240	NV	
39. Zinc*	1	24,000	5,970	226	

Table D3-4. Master 100-F Target Analyte List

Target Analyte	Practical Quantitation Limits (PQLs)	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	
40. Mercury*	0.2	24	2.09	0.33[b]	9. EPA 7471 (Hg cold vapor)
41. Aroclor-1016 (PCB)	0.017	0.5	0.0942	0.000447[d]	10. EPA 8082 (PCB by GC)
42. Aroclor-1221(PCB)	0.017	0.5	0.00920[d]	0.0000437[d]	
43. Aroclor-1232(PCB)	0.017	0.5	0.00920[d]	0.0000437[d]	
44. Aroclor-1242(PCB)	0.017	0.5	0.0394	0.000187[d]	
45. Aroclor-1248(PCB)	0.017	0.5	0.0386	0.000183[d]	
46. Aroclor-1254 (PCB)	0.017	0.5	0.0664	0.000315[d]	
47. Aroclor-1260 (PCB)	0.017	0.5	0.721	0.00342[d]	
48. 2-methylnapthalene	0.33	320	2.03	4.07	11. EPA-8270 (Semi-volatiles)
49. Carbazole	0.33	50	0.314[d]	NV	
50. Dibenzofuran	0.33	160	7.36	NV	
51. Phthalate (butyl benzyl)	0.33	16,000	893	698	
52. Phthalate (bis 2-ethylhexyl)	0.33	71.4	13.9	8.01	
53. Phthalate (di-ethyl)	0.33	64,000	72.2	259	
54. Phthalate (di-methyl)	0.33	80,000	75.9	683	
55. Phthalate (di-n-butyl)	0.33	8,000	56.5	191	
56. Phenol	0.33	24,000	11	192	
57. *1,1-Dichloroethene (GW COPC)*	0.01	1.67	0.0005	0.0008	12. EPA-8260 (Volatile organics)
58. 2-butanone	0.01	48,000	19.6	NV	
59. 2-hexanone	0.02	3,200	2.73	NV	
60. 4-methyl-2-pentanone	0.01	6400	2.71	NV	
61. Acetone	0.02	72,000	28.9	NV	
62. *Carbon Tetrachloride (GW COPC)*	0.005	7.69	0.031	0.0046[c]	
63. Chlorobenzene	0.005	1,600	0.874	11.9	
64. Chloroform*	0.005	164	0.038	0.0607	
65. Ethylbenzene	0.005	8,000	6.05	53.6	
66. Methylene chloride	0.005	133	0.0218	0.0409	
67. Styrene*	0.005	33.3	0.0328	NV	
68. Tetrachloroethene*	0.005	800	0.008	0.008	

Table D3-4. Master 100-F Target Analyte List

Target Analyte	Practical Quantitation Limits (PQLs)	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	
69. *Trichloroethene (GW COPC)*	0.005	11.2	0.00323[d]	0.0355	
70. Toluene	0.005	NV	4.65	99	
71. *Vinyl Chloride (GW COPC)*	0.001	87.5	0.00018[c]	0.0252	
72. Xylene	0.01	16,000	14.6	183	
73. Benzo(a)pyrene	0.015	0.137	2.33	0.109	13. EPA-8310 (PAH)
74. Chrysene	0.1	13.7	9.56	0.0446[d]	
75. Fluorene	0.03	3,200	101	411	
76. Indeno(1,2,3-cd)pyrene	0.03	1.37	8.33	0.389	
77. Acenaphthene	0.1	4,800	97.9	131	
78. Anthracene	0.05	24,000	1,140	9,100	
79. Benzo(a)anthracene	0.015	1.37	0.856	0.04	
80. Benzo(b) fluoranthene	0.015	1.37	2.95	0.138	
81. Benzo(g,h,i)perylene	0.03	2,400	25,700	7,070	
82. Benzo(k) fluoranthene	0.015	1.37	21.5	0.138	
83. Dibenz(a,h)anthracene	0.03	1.37	4.29	0.2	
84. Fluoranthene	0.05	3,200	631	178	
85. Napthalene	0.1	1,600	4.46	275	
86. Phenanthrene	0.05	24,000	1,140	9100	
87. Pyrene	0.05	2,400	655	2620	
88. Dalapon	0.1	2,400	0.811	1.62	14. EPA-8151 (Herbicides)
89. BHC-Alpha	0.00165	0.159	0.000545[d]	0.0006[d]	15. EPA-8081 (Pesticides)
90. Heptachlor epoxide	0.00165	0.11	0.008	0.002[d]	
91. 4,4'-DDD	0.0033	4.17	0.335	0.000464[d]	
92. 4,4'-DDE	0.0033	2.94	0.446	0.00123[d]	
93. 4,4'-DDT	0.0033	2.94	3.49	0.00965	
94. Aldrin	0.00165	0.0588	0.005	0.00016[d]	
95. Chlordane (alpha, gamma)	0.0165	2.86	2.06	0.00117[d]	
96. BHC- beta	0.00165	0.556	0.00227	0.00259	

Table D3-4. Master 100-F Target Analyte List

Target Analyte	Practical Quantitation Limits (PQLs)	Preliminary Cleanup Goals[a] Direct Exposure	Groundwater Protection	River Protection	Analytical Methods
97. Endosulfan I	0.00165	480	4.3	0.0833	
98. Endosulfan sulfate	0.0033	480	4.3	0.0833	
99. Endrin aldehyde	0.0033	24	0.44	0.335	
100. Endrin ketone	0.0033	24	0.44	0.335	
101. Methoxychlor	0.0165	400	64.2	26.8	
102. Toxaphene	0.165	0.909	0.153[d]	0.00173[d]	
103. Petroleum Hydrocarbons	5	2,000	2,000	NV	16. WTPH-D+

Note: Analytes in *italics* were added GW COPCs.

Reference: Ecology, 2007, "Model Toxics Control Act Statute and Regulation," Publication No. 94-06, revised November 2007, Washington State Department of Ecology, Olympia, Washington.

* Soil target analyte is also a GW COPC.

a. Units are mg/kg (nonradionuclides) and pCi/g (radionuclides) unless otherwise noted. Cleanup levels are established in the most current CLARC Table (updated April 22, 2009) calculated per WAC-173-340 (Ecology 2007) using input parameters stated in the CLARC Table.

b. Where cleanup levels are less than background, cleanup levels default to background as discussed in Sec. 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL-96-17).

c. The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Sec. 2.1.2.1 of the 100 Area Remedial Design Report/Remedial Action Work Plan (DOE-RL-96-17).

d. Where cleanup levels are less than PQLs, cleanup levels default to PQLs as discussed in Sec. 2.1.2.1 of the 100 Area Remedial Design Report/Remedial Action Work Plan (DOE-RL-96-17). The PQLs will be used for working levels, and will be periodically reviewed to establish if lower detection limit capabilities have become available.

AEA = alpha energy analysis
EPA = U.S. Environmental Protection Agency
GC = gas chromatograph
GW COPC = groundwater contaminant of potential concern
IC = ion chromatography
ICP = inductively coupled plasma
KPA = kinetic phosphorescence analysis
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PQL = practical quantitation limits
WTPH = Washington total petroleum hydrocarbon

4. This step reconciles the master soil target analytes with the groundwater COPCs developed for the area. Groundwater COPCs not found on the master soils list are further evaluated. The default action is to include all groundwater COPCs on the master soil target analyte list, unless there is a valid basis for their exclusion. The analytes added to Table 4 that are groundwater COPCs are presented in italics and labeled "GW COPC."

5. The appropriate analytical methods for the master target analytes, taking into account action levels and detection limits, are presented in Table 4.

Location-Specific Target Analyte Identification

1. Identify the contaminants of concern for the specific waste sites where characterization is proposed from the applicable interim action ROD (which reflects information from LFI and technical baseline reports). If the characterization location is not at a waste site, evaluate information from waste sites in the vicinity (where available). Include these analytes on the location specific target analyte list (Tables D3-5 through D3-7).

2. Identify the contaminants of concern for the specific waste site locations from the verification documentation (CVPs or RSVPs). If the characterization location is not at a waste site, evaluate information from waste sites in the vicinity (where available). Include these analytes on the location specific target analyte list (Tables 5 through 7).

3. Evaluate local groundwater monitoring well data (wells located within waste site "zones of influence"). Determine if groundwater COPCs have been analyzed for in these wells.

   a. If the groundwater COPCs have been analyzed for but not detected, then these analytes will not be included on the location specific target analyte list.

   b. If the groundwater COPCs have been analyzed for and have been detected, then these analytes are included on the location specific target analyte list.

   c. If the groundwater COPCs have not been analyzed for, then an additional evaluation will be performed to determine if there is a data need. If there is a data need, these COPCs are included on the location specific target analyte list.

The following location-specific target analyte tables present the final results of Step 3 (development of location-specific target analyte list) and Step 4 (regulatory agency review of characterization location and location-specific target analyte list).

Table D3-5. 116-F-14 Target Analytes, Analytical Methods, and Contract-Required Detection Limits

Target Analyte	Practical Quantitation Limits[a]	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	
Radionuclides					
1. Cesium-137*	0.1	6.2	NV	NV	1. Gamma energy analysis
2. Cobalt-60	0.05	1.4	NV	NV	
3. Europium-152	0.1	3.3	NV	NV	
4. Europium-154*	0.1	3.0	NV	NV	
5. Europium-155	0.1	125	NV	NV	
6. Carbon-14*	2	5.16	NV	NV	2. Liquid scintillation counter
7. Nickel-63*	30	4,026	NV	NV	
8. Technetium-99	0.25	5.7	0.46	0.46	
9. Tritium	10	510	15.8	15.8	

Table D3-5. 116-F-14 Target Analytes, Analytical Methods, and Contract-Required Detection Limits

Target Analyte	Practical Quantitation Limits[a]	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	
10. Strontium-90*	1	4.5	NV	NV	3. Gas flow proportional counting
11. Plutonium-238	1	37.4	NV	NV	4. Isotopic – plutonium
Nonradionuclides					
12. *Fluoride*	5	4,800	12,000	24,000	5. Anions by IC 300.0
13. *Nitrate*	2.5	128,000	40	80	
14. *Antimony*	6	32	5.4	25.3	6. EPA 6010 (ICP metal)
15. *Arsenic*	10	20[c]	20[c]	20[c]	
16. *Barium*	2	16,000	1,650	3,300	
17. *Boron*	2	16,000	210	NV	
18. Cobalt	2	24	15.7[b]	NV	
19. Chromium (total)*	1	120,000	2,000	2,600	
20. *Copper*	1	3,200	284	1,150	
21. *Lead*	5	250	3,000	840	
22. *Manganese*	5	3,760	512[c]	512[c]	
23. *Molybdenum*	2	400	32.3	NV	
24. *Nickel*	4	1,600	130	357	
25. *Selenium*	10	400	5.2[d]	1.04[d]	
26. *Thallium*	5	5.60	1.59[d]	4.46[d]	
27. *Vanadium*	2.5	560	2,240	NV	
28. *Zinc*	1	24,000	5,970	226	
29. Chromium (hexavalent) *	0.5	240	18.4	7.7	7. Cr VI 7196
30. *2-butanone*	0.01	48,000	19.6	NV	8. EPA-8260 (volatile organics)
31. *Acetone*	0.02	72,000	28.9	NV	
32. *Chloroform*	0.005	164	0.038	0.0607	
33. *Methylene chloride*	0.005	133	0.0218	0.0409	
34. *Trichloroethene*	0.005	11.2	0.00323[d]	0.0355	
35. *Xylene*	0.01	16,000	14.6	183	
36. *Heptachlor epoxide*	0.00165	0.11	0.008	0.002[d]	9. EPA-8081 (pesticides)

Table D3-5. 116-F-14 Target Analytes, Analytical Methods, and Contract-Required Detection Limits

Target Analyte	Practical Quantitation Limits[a]	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	

Note: Contaminant of potential concern from CVP-2001-00009.

* Soil target analyte is also a GW COPC.

Note: Analytes in *italics* were added GW COPCs.

a. Units are mg/kg (nonradionuclides) and pCi/g (radionuclides) unless otherwise noted. Cleanup levels are established in the most current CLARC Table (updated April 22, 2009) calculated per WAC-173-340 (Ecology 2007) using input parameters stated in the CLARC Table.

b. Where cleanup levels are less than background, cleanup levels default to background as discussed in Sec. 2.1.2.1 of the 100 Area Remedial Design Report/Remedial Action Work Plan (DOE-RL-96-17).

c. The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Sec. 2.1.2.1 of the 100 Area Remedial Design Report/Remedial Action Work Plan (DOE-RL-96-17).

d. Where cleanup levels are less than PQLs, cleanup levels default to PQLs as discussed in Sec. 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL-96-17).

AEA = alpha energy analysis

EPA = U.S. Environmental Protection Agency

GC = gas chromatograph

GW COPC = groundwater contaminant of potential concern

IC = ion chromatography

ICP = inductively coupled plasma

KPA = kinetic phosphorescence analysis

NV = No value. The generic RESidual RADioactivity modeling reported in the DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* predicts the contaminant will not reach groundwater within 1,000 years.

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

PQL = practical quantitation limits

Table D3-6. 118-F-1 Location-Specific Target Analyte Lists

Target Analyte	Practical Quantitation Limits[a]	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	
Radionuclides					
1. Uranium-238	1	1.1[b]	1.1[b]	1.1[b]	1. Isotopic - uranium
2. Americium-241	1	31.1	NV	NV	2. Gamma energy analysis
3. Silver-108m*	0.2	2.38	NV	NV	
4. Cesium-137	0.1	6.2	NV	NV	
5. Cobalt-60	0.05	1.4	NV	NV	
6. Europium-152	0.1	3.3	NV	NV	
7. Europium-154	0.1	3.0	NV	NV	

Table D3-6. 118-F-1 Location-Specific Target Analyte Lists

Target Analyte	Practical Quantitation Limits[a]	Preliminary Cleanup Goals[a] Direct Exposure	Groundwater Protection	River Protection	Analytical Methods
8. Plutonium-238	1	37.4	NV	NV	3. Isotopic-Pu
9. Plutonium-239/240	1	33.9	NV	NV	
10. Strontium-90*	1	4.5	NV	NV	4. Gas flow proportional counting
11. Carbon-14*	2	5.16	NV	NV	5. Liquid scintillation counter
12. Nickel-63*	30	4,026	NV	NV	
13. *Technetium-99*	0.25	5.7	0.46	0.46	
14. Tritium*	10	510	15.8	15.8	
Nonradionuclides					
15. *Fluoride*	5	4,800	12,000	24,000	6. Anions by IC 300.0
16. *Nitrate*	2.5	128,000	40	80	
17. *Chromium (hexavalent)*	0.5	240	18.4	7.7	7. Cr VI 7196
18. *Arsenic*	10	20[c]	20[c]	20[c]	8. EPA 6010 (ICP metal)
19. *Barium*	2	16,000	1,650	3,300	
20. *Boron*	2	16,000	210	NV	
21. Cadmium	0.5	80	0.69	0.25[d]	
22. *Chromium (total)*	1	120,000	2,000	2,600	
23. *Copper*	1	3,200	284	1,150	
24. Lead*	5	250	3,000	840	
25. *Manganese*	5	3,760	512[c]	512[c]	
26. *Molybdenum*	2	400	32.3	NV	
27. *Nickel*	4	1,600	130	357	
28. *Vanadium*	2.5	560	2,240	NV	
29. *Zinc*	1	24,000	5,970	226	
30. Mercury	0.2	24	2.09	0.33[b]	9. EPA 7471 (Hg cold vapor)
31. *Acetone*	0.02	72,000	28.9	NV	10. EPA-8260 (volatile organics)
32. *Chloroform*	0.005	164	0.038	0.0607	
33. *Methylene chloride*	0.005	133	0.0218	0.0409	

Notes:

Contaminant of potential concern from CVP-2007-00001.

Analytes in *italics* were added groundwater COPCs.

* Soil target analyte is also a GW COPC.

Table D3-6. 118-F-1 Location-Specific Target Analyte Lists

Target Analyte	Practical Quantitation Limits[a]	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	

a. Units are mg/kg (nonradionuclides) and pCi/g (radionuclides) unless otherwise noted. Cleanup levels are established in the most current CLARC Table (updated April 22, 2009) calculated per WAC-173-340 (Ecology 2007) using input parameters stated in the CLARC Table.

b. Where cleanup levels are less than background, cleanup levels default to background as discussed in Section 2.1.2.1 of DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*.

c. The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*.

d. Where cleanup levels are less than PQLs, cleanup levels default to PQLs as discussed in Section 2.1.2.1 of DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*. The PQLs will be used for working levels, and will be periodically reviewed to establish if lower detection limit capabilities have become available.

Reference: Ecology, 2007, "Model Toxics Control Act Statute and Regulation," Publication No. 94-06, revised November 2007, Washington State Department of Ecology, Olympia, Washington.

CVP = cleanup verification package

EPA = U.S. Environmental Protection Agency

GW COPC = groundwater contaminant of potential concern

IC = ion chromatography

ICP = inductively coupled plasma

PQL = practical quantitation limits

WAC = *Washington Administrative Code*

NV = No value. The generic RESidual RADioactivity modeling reported in the DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* predicts the contaminant will not reach groundwater within 1,000 years.

Table D3-7. 118-F-8 Location-Specific Target Analyte Lists

Target Analyte	Practical Quantitation Limits	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	
Radionuclides					
1. Cesium-137*	0.1	6.2	NV	NV	1. Gamma energy analysis
2. Cobalt-60*	0.05	1.4	NV	NV	
3. Europium-152	0.1	3.3	NV	NV	
4. Europium-154*	0.1	3.0	NV	NV	
5. Europium-155	0.1	125	NV	NV	
6. Americium-241*	1	31.1	NV	NV	
7. Barium-133*	0.2	11.8	NV	NV	

Table D3-7. 118-F-8 Location-Specific Target Analyte Lists

Target Analyte	Practical Quantitation Limits	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	
8. Strontium-90*	1	4.5	NV	NV	2. Gas flow proportional counting
9. Plutonium-238	1	37.4	NV	NV	3. Isotopic - plutonium
10. Plutonium-239/240	1	33.9	NV	NV	
11. Uranium-233/234	1	1.1[b]	1.1[b]	1.1[b]	4. Isotopic - uranium
12. Uranium-235	1	0.61	0.185[d]	0.185[d]	
13. Uranium-238	1	1.1[b]	1.1[b]	1.1[b]	
14. Carbon-14*	2	5.16	NV	NV	5. Liquid scintillation counter
15. Nickel-63*	30	4,026	NV	NV	
16. Technetium-99*	0.25	5.7	0.46	0.46	
17. Tritium*	10	510	15.8	15.8	
Nonradionuclides					
18. *Fluoride*	5	4,800	12,000	24,000	6. Anions by IC 300.0
19. *Nitrate*	2.5	128,000	40	80	
20. Chromium (hexavalent)*	0.5	240	18.4	7.7	7. Cr VI 7196
21. *Antimony*	6	32	5.4	25.3	8. EPA 6010 (ICP metal)
22. *Arsenic*	10	20[c]	20[c]	20[c]	
23. *Barium**	2	16,000	1,650	3,300	
24. *Beryllium*	0.5	160	63.2	126	
25. *Cadmium*	0.5	80	0.69	0.25[d]	
26. *Chromium (total)*	1	120,000	2,000	2,600	
27. *Cobalt*	2	24	15.7[d]	NV	
28. *Copper*	1	3,200	284	1,150	
29. Lead*	5	250	3,000	840	
30. *Manganese*	5	3,760	512[c]	512[c]	
31. *Nickel*	4	1,600	130	357	
32. Selenium*	10	400	5.2[d]	1.04[d]	
33. *Silver*	1	400	13.6	0.884	
34. *Thallium*	5	5.6	1.59	4.46	
35. *Vanadium*	2.5	560	2,240	NV	
36. *Zinc*	1	24,000	5,970	226	

Table D3-7. 118-F-8 Location-Specific Target Analyte Lists

Target Analyte	Practical Quantitation Limits	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	
37. Mercury	0.2	24	2.09	0.33[b]	9. EPA 7471 (Hg cold vapor)
38. Aroclor-1016 (PCB)	0.017	0.5	0.0942	0.000447[d]	10. EPA 8082 (PCB by GC)
39. Aroclor-1221(PCB)	0.017	0.5	0.00920[d]	0.0000437[d]	
40. Aroclor-1232(PCB)	0.017	0.5	0.00920[d]	0.0000437[d]	
41. Aroclor-1242(PCB)	0.017	0.5	0.0394	0.000187[d]	
42. Aroclor-1248(PCB)	0.017	0.5	0.0386	0.000183[d]	
43. Aroclor-1254 (PCB)	0.017	0.5	0.0664	0.000315[d]	
44. Aroclor-1260 (PCB)	0.017	0.5	0.721	0.00342[d]	
45. *Acetone*	0.02	72,000	28.9	NV	11. EPA-8260 (volatile organics)
46. *Chloroform*	0.005	164	0.038	0.0607	
47. *Methylene chloride*	0.005	133	0.0218	0.0409	
48. *Toluene*	0.005	NV	4.65	99	
49. *Trichloroethene*	0.005	11.2	0.003	0.090	
50. *Heptachlor epoxide*	0.00165	0.11	0.008	0.002[d]	12. EPA-8081 (pesticides)
51. *Uranium (total)*	1	240	3.21[b]	3.21[b]	13. U-KPA or via isotopic

Notes:

Analytes in *italics* were added groundwater COPCs.

Contaminants of potential concern from CVP-2007-00004 and CVP-2003-00017.

* Soil target analyte is also a GW COPC.

a. Units are mg/kg (nonradionuclides) and pCi/g (radionuclides) unless otherwise noted. Cleanup levels are established in the most current CLARC Table (updated 4/22/2009) calculated per WAC-173-340 (Ecology 2007) using input parameters stated in the CLARC Table.

b. Where cleanup levels are less than background, cleanup levels default to background as discussed in Section 2.1.2.1 of DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*.

c. The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement project managers as discussed in Section 2.1.2.1 of DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*.

d. Where cleanup levels are less than PQLs, cleanup levels default to PQLs as discussed in Section 2.1.2.1 of DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*. The PQLs will be used for working levels and will be periodically reviewed to establish if lower detection limit capabilities have become available.

Table D3-7. 118-F-8 Location-Specific Target Analyte Lists

Target Analyte	Practical Quantitation Limits	Preliminary Cleanup Goals[a]			Analytical Methods
		Direct Exposure	Groundwater Protection	River Protection	

Reference: Ecology, 2007, "Model Toxics Control Act Statute and Regulation," Publication No. 94-06, revised November 2007, Washington State Department of Ecology, Olympia, Washington.

AEA = alpha energy analysis
EPA = U.S. Environmental Protection Agency
GC = gas chromatograph
GW COPC = groundwater contaminant of potential concern
IC = ion chromatography
ICP = inductively coupled plasma
KPA = kinetic phosphorescence analysis
NV = No value. The generic RESidual RADioactivity modeling reported in the DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* predicts the contaminant will not reach groundwater within 1,000 years.
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PQL = practical quantitation limits

D3.6 Conclusions

This soil target analyte list development approach should be followed to identify target analytes for the other 100 and 300 Area RI/FS work plans and addenda under development

The analytical methods in Tables 4, 5, 6 and 7, particularly those identified for radionuclides, should be verified and documented in the quality assurance project plan section of the sampling and analysis plan for the 100-F Area. As additional soil data become available, other suitable exclusion criteria should be considered and evaluated for use in the target analyte list development process.

D3.7 References

The references used in this document are listed in Table D3-1.

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Distribution

	MS	Quantity
U.S. Department of Energy, Richland Operations Office		
K.M. Thompson	A6-38	60
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